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DMD50

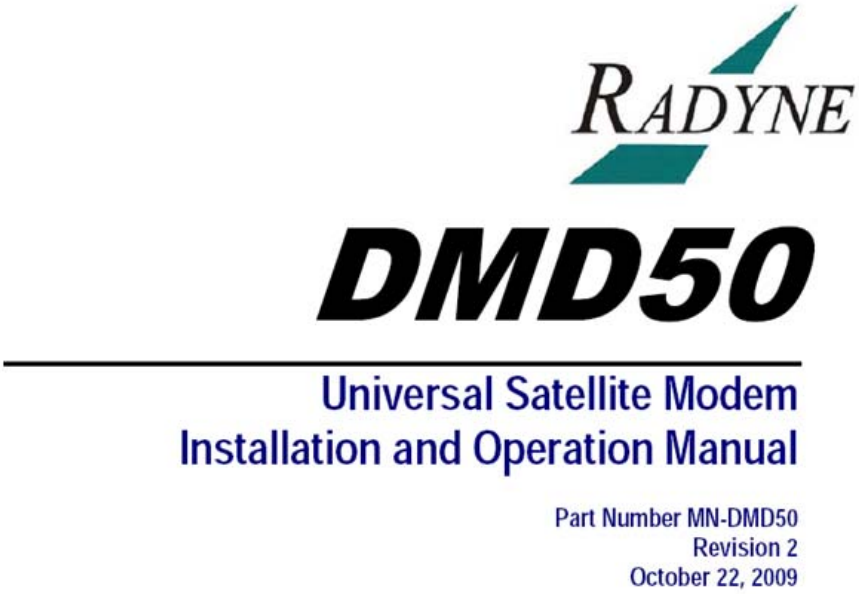
Universal Satellite Modem
Installation and Operation Manual

IMPORTANT NOTE: The information contained in this document supersedes all previously published information regarding this product. This manual is subject to change without prior notice.

Part Number MN-DMD50 Revision 3

Errata A

Comtech EF Data Documentation Update



Subject: Revise “Trademarks” subsection in Preface to include CEFD Patents and Patents Pending note

Original Manual Part Number/Rev: MN-DMD50 Rev 2

Errata Number/ PLM Document ID: ER-DMD50.EA2

PLM CO Number: C-0022887

Comments: The updated information will be incorporated into the next formal revision of the manual.

Update the manual Preface: Revise the ‘Trademarks’ section to read (addition in bold):

Trademarks

Product names mentioned in this manual may be trademarks or registered trademarks of their respective companies and are hereby acknowledged.

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Errata B

Comtech EF Data Documentation Update

DMD50 Universal Satellite Modem

Manual Part Number: MN-DMD50

Revision: Rev 3

Errata Subject: Updates to registered trademarks and licenses for Raytheon Applied Signal Technology, DoubleTalk and Carrier-in-Carrier

Errata Part Number: ER-MNDMD50-EB3

CO Number: C-0023089

Comments: Attach Errata to Preface, page 1.

Note:
"Applied Signal Technology, Inc." is now "Raytheon Applied Signal Technology". All references to "Applied Signal Technology, Inc." in this manual are changed to "Raytheon Applied Signal Technology".

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- DoubleTalk® is a registered trademark of "Raytheon Applied Signal Technology".
- Carrier-in-Carrier® is a registered trademark of Comtech EF Data.

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DMD50

Universal Satellite Modem
Installation and Operation Manual

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Part Number MN-DMD50
Revision 3
January 13, 2011

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PREFACE

About this Manual

This manual describes the installation and operation for the Radyne DMD50. This is a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the DMD50.

Reporting Comments or Suggestions Concerning this Manual

Comments and suggestions regarding the content and design of this manual will be appreciated. To submit comments, please contact the Comtech EF Data Technical Publications Department:

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Conventions and References

Related Documents

The following documents are referenced in this manual:

- EN300-421 and EN301-210 ETSI
- ETSI EN302-307
- *INTELSAT Earth Station Standards IESS-308, -309, -310, and -315*
- *EUTELSAT SMS*

Metric Conversion

Metric conversion information is located on the inside back cover of this manual. This information is provided to assist the operator in cross-referencing non-Metric to Metric conversions.

Cautions and Warnings

WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation that, if not avoided, may result in minor or moderate injury. CAUTION may also be used to indicate other unsafe practices or risks of property damage.

IMPORTANT or NOTE indicates information critical for proper equipment function.

Recommended Standard Designations

Recommended Standard (RS) Designations have been superseded by the new designation of the Electronic Industries Association (EIA). References to the old designations are shown only when depicting actual text displayed on the screen of the unit (RS-232, RS-485, etc.). All other references in the manual will be shown with the EIA designations.

The user should carefully review the following information.

Electrical Safety

The DMD50 has been shown to comply with the **EN 60950-1 Safety of Information Technology Equipment (including electrical business machines)** safety standard.

The equipment is rated for a nominal operating range of 100 - 240 volts AC or an appropriately equipped DC option, nominal operating range is 48+/-5 volts DC . The unit has a maximum power consumption of 250 watts.

Battery

The modem contains a Lithium Battery. DANGER OF EXPLOSION EXISTS if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries in accordance with local and national regulations.

Grounding

PROPER GROUNDING PROTECTION REQUIRED: The installation instructions require that the integrity of the protective earth must be ensured and that the equipment shall be connected to the protective earth connection at all times. Therefore, it is imperative during installation, configuration, and operation that the user ensures that the unit has been properly grounded using the ground stud provided on the rear panel of the unit.

- **In Finland:** ***"Laite on liitettävä suojamaadoituskoskettimilla varustettuun pistorasiaan."***
- **In Norway:** ***"Apparatet må tilkoples jordet stikkontakt."***
- **In Sweden:** ***"Apparaten skall anslutas till jordat uttag."***

Fuses

FOR CONTINUED OPERATOR SAFETY, ALWAYS REPLACE THE FUSES WITH THE CORRECT TYPE AND RATING.

The DMD50 contains no Fuses.

Environmental

The DMD50 must not be operated in an environment where the unit is exposed to precipitation; condensation; humid atmospheres above 95% RH; altitudes (unpressurized) greater than 2000 metres; excessive dust or vibration; flammable gases, corrosive or explosive atmospheres; or extremes of temperature outside the ambient range 0 to +50°C. Maximum storage temperature allowed is -20 to +70°C.

Operation in vehicles or other transportable installations that are equipped to provide a stable environment is permitted. If such vehicles do not provide a stable environment, safety of the equipment to EN 60950 may not be guaranteed.

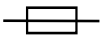
Installation

PROPER GROUNDING PROTECTION IS REQUIRED – REFER TO THE GROUNDING 'CAUTION' NOTE PROVIDED ON THE PREVIOUS PAGE. The DMD50 is designed for connection to a power system that has separate ground, line and neutral conductors. The equipment is <u>not</u> designed for connection to a power system that has no direct connection to ground.

The installation and connection to the line supply must be made in compliance to local or national wiring codes and regulations.

The DMD50 is shipped with a line inlet cable suitable for use in the country of operation. If it is necessary to replace this cable, ensure the replacement has an equivalent specification. Examples of acceptable ratings for the cable include HAR, BASEC and HOXXX-X. Examples of acceptable connector ratings include VDE, NF-USE, UL, CSA, OVE, CEBEC, NEMKO, DEMKO, BS1636A, BSI, SETI, IMQ, KEMA-KEUR and SEV.

International Symbols

Symbol	Definition	Symbol	Definition
	Alternating Current		Protective Earth
	Fuse		Chassis Ground

Telecommunications Terminal Equipment Directive

In accordance with the Telecommunications Terminal Equipment Directive 91/263/EEC, this equipment should not be directly connected to the Public Telecommunications Network.

CE Mark

Comtech EF Data declares that the DMD50 modem meets the necessary requirements for the CE Mark.

RoHS Compliancy

This unit satisfies (with exemptions) the requirements specified in the European Union Directive on the Restriction of Hazardous Substances, Directive 2002/95/EC (EU RoHS).

EMC (Electromagnetic Compatibility)

In accordance with European Directive 2004/108/EEC, the DMD50 has been shown, by independent testing, to comply with the following standards:

Emissions: EN 55022 Class B - Limits and methods of measurement of radio interference characteristics of Information Technology Equipment.

(Also tested to FCC Part 15 Class B.)

Immunity: EN 55024 – Information Technology Equipment: Immunity Characteristics, Limits, and Methods of Measurement.

Additionally, the DMD50 has been shown to comply with the following standards:

EN 61000-3-2 – Harmonic Currents Emission;

EN 61000-3-3 – voltage Fluctuations and Flicker.

To ensure that the Modem continues to comply with these standards, observe the following instructions:

- Connections to the transmit and receive IF ports should be made using a good quality coaxial cable. For example, RG58 or RG59 for BNC IF connectors and LMR200, LMR240 or equivilant for the L-band SMA IF ports.
- All 'D' type connectors attached to the rear panel must have back-shells that provide continuous metallic shielding. Cable with a continuous outer shield (either foil or braid, or both) must be used, and the shield must be bonded to the back-shell.
- The equipment must be operated with its cover on at all times. If it becomes necessary to remove the cover, the user should ensure that the cover is correctly re-fitted before normal operation commences.

Warranty Policy

Comtech EF Data products are warranted against defects in material and workmanship for a specific period from the date of shipment, and this period varies by product. In most cases, the warranty period is two years. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective. Repairs are warranted for the remainder of the original warranty or a 90 day extended warranty, whichever is longer. Contact Comtech EF Data for the warranty period specific to the product purchased.

For equipment under warranty, the owner is responsible for freight to Comtech EF Data and all related customs, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges only for return of the equipment from the factory to the owner. Comtech EF Data will return the equipment by the same method (i.e., Air, Express, Surface) as the equipment was sent to Comtech EF Data.

All equipment returned for warranty repair must have a valid RMA number issued prior to return and be marked clearly on the return packaging. Comtech EF Data strongly recommends all equipment be returned in its original packaging.

Comtech EF Data Corporation's obligations under this warranty are limited to repair or replacement of failed parts, and the return shipment to the buyer of the repaired or replaced parts.

Limitations of Warranty

The warranty does not apply to any part of a product that has been installed, altered, repaired, or misused in any way that, in the opinion of Comtech EF Data Corporation, would affect the reliability or detracts from the performance of any part of the product, or is damaged as the result of use in a way or with equipment that had not been previously approved by Comtech EF Data Corporation.

The warranty does not apply to any product or parts thereof where the serial number or the serial number of any of its parts has been altered, defaced, or removed.

The warranty does not cover damage or loss incurred in transportation of the product.

The warranty does not cover replacement or repair necessitated by loss or damage from any cause beyond the control of Comtech EF Data Corporation, such as lightning or other natural and weather related events or wartime environments.

The warranty does not cover any labor involved in the removal and or reinstallation of warranted equipment or parts on site, or any labor required to diagnose the necessity for repair or replacement.

The warranty excludes any responsibility by Comtech EF Data Corporation for incidental or consequential damages arising from the use of the equipment or products, or for any inability to use them either separate from or in combination with any other equipment or products.

A fixed charge established for each product will be imposed for all equipment returned for warranty repair where Comtech EF Data Corporation cannot identify the cause of the reported failure.

Exclusive Remedies

Comtech EF Data Corporation's warranty, as stated is in lieu of all other warranties, expressed, implied, or statutory, including those of merchantability and fitness for a particular purpose. The buyer shall pass on to any purchaser, lessee, or other user of Comtech EF Data Corporation's products, the aforementioned warranty, and shall indemnify and hold harmless Comtech EF Data Corporation from any claims or liability of such purchaser, lessee, or user based upon allegations that the buyer, its agents, or employees have made additional warranties or representations as to product preference or use.

The remedies provided herein are the buyer's sole and exclusive remedies. Comtech EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Customer Support

Refer to p. xxiv for information regarding this product's Warranty Policy.

Contact the Comtech EF Data Customer Support Department for:

- Product support or training
- Reporting comments or suggestions concerning manuals
- Information on upgrading or returning a product

A Customer Support representative may be reached at:

Comtech EF Data
Attention: Customer Support Department
2114 West 7th Street
Tempe, Arizona 85281 USA
480.333.2200 (Main Comtech EF Data number)
480.333.4357 (Customer Support Desk)
480.333.2161 FAX

To return a Comtech EF Data product (in-warranty and out-of-warranty) for repair or replacement:

- **Contact** the Comtech EF Data Customer Support Department. Be prepared to supply the Customer Support representative with the model number, serial number, and a description of the problem.
- **Request** a Return Material Authorization (RMA) number from the Comtech EF Data Customer Support representative.
- **Pack** the product in its original shipping carton/packaging to ensure that the product is not damaged during shipping.
- **Ship** the product back to Comtech EF Data. (Shipping charges should be prepaid.)

Online Customer Support

An RMA number request can be requested electronically by contacting the Customer Support Department through the online support page at **www.comtechefdata.com/support.asp**:

- **Click** on "Return Material Authorization" for detailed instructions on our return procedures.
- **Click** on the "RMA Request Form" hyperlink, then fill out the form completely before sending.
- **Send e-mail** to the Customer Support Department at **service@comtechefdata.com**.

Notes:

Chapter 1. Introduction

This chapter provides an overview of the DMD50 Universal Satellite Modem. When describing the equipment, it may be referred to as “the modem”, or “the unit”.

1.1 Overview

The Radyne Universal Satellite Modem (Figure 1-1) offers the best features of a sophisticated programmable IBS/IDR and Closed Network Modem, at an affordable price.

Figure 1-1. Universal Satellite Modem Front Panel

This versatile equipment package combines unsurpassed performance with numerous user-friendly Front Panel Programmable Functions. The unit provides selectable functions for different services: Intelsat IDR and IBS, as well as closed networks. All of the configuration and Monitor and Control (M&C) Functions are available at the Front Panel. Operating parameters, such as variable data rates, FEC Code Rate, modulation type, IF Frequencies, IBS/IDR Framing and interface type can be readily set and changed at the Front Panel by earth station operations personnel.

The modem operates at all standard IBS and IDR Data Rates up to 8.448 Mbps. Selection of any data rate is provided over the range of 2.4 Kbps to 52 Mbps in 1 bps steps.

For applications requiring system redundancy, the Modem may be used with the Radyne RCS11 1:1 Redundancy Switch or the RCS20 M:N (N < 9) Redundancy Switch. An Internal Engineering Service Channel Unit is available to provide voice, data, and alarms for Intelsat IDR applications.

A full range of Industry Standard Interfaces are available. Interface types are selectable from V.35, RS-232, RS-422/-530, ITU G.703, HSSI, ASI, DVB/M2P and Ethernet Bridge.

1.2 Configurations

The unit can be configured in the following ways:

- Features and options that are installed when the unit is ordered
- Feature upgrades
- Hardware options that are installed to a unit that is sent to a Comtech facility
- Hardware options that the user can install at their own location

1.2.1 Features/Options Installed at Time of Order

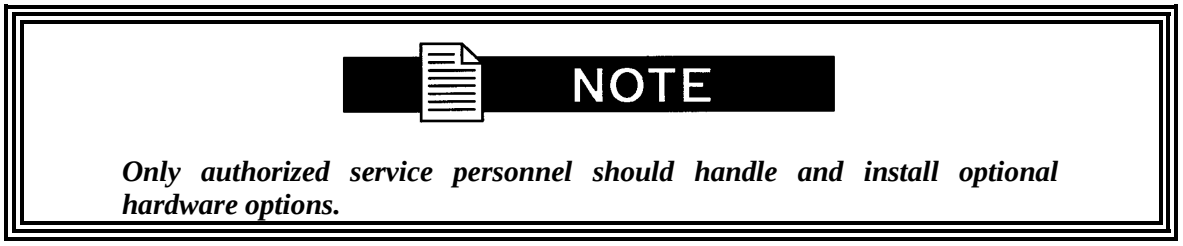
Features installed at the time of ordering are the options pre-installed/initialized in the factory prior to shipment. These can be reviewed from the front panel. Refer to Chapter 4, User Interfaces, for information on how to view these features. Factory installed options are chassis and board configurations that are introduced during manufacture.

1.2.2 Feature Upgrades

Feature Upgrades are a simple and quick way of changing the feature set of an installed modem. Feature upgrades are how most options are implemented. Features may be purchased at any time by contacting a Comtech Corp. salesperson. Refer to Chapter 4 and Appendix D, for information on how upgrade features are enabled.

1.2.3 Hardware Options

Hardware options (refer to Appendix A) are purchased parts that can be installed into the unit at the customer's site. A screwdriver is normally the only tool required. Please contact the Customer Service Department for information not limited to availability and to shipping costs.



1.2.4 Factory Installed Options

Units may also be sent to the factory for hardware option installation. Please contact the Customer Service Department for information not limited to availability and to shipping costs.

1.3 Function Accessibility

All functions can be accessed with a terminal or personal computer via a serial link for complete remote monitoring and control capability.

Chapter 2. Installation

2.1 Unpacking and Inspection

Inspect shipping containers for damage. If shipping containers are damaged, keep them until the contents of the shipment have been carefully inspected and checked for normal operation. The Universal Satellite Modem and its Installation and Operation Manual are packaged and shipped in a pre-formed, reusable cardboard carton containing foam spacing for maximum shipping protection.

Do not use any cutting tool that will extend more than 1/2 inch into the container. This can cause damage to the modem.

Unpack and inspect the modem as follows:

Step	Procedure
1	Cut the tape at the top of the carton indicated by OPEN THIS END.
2	Remove the cardboard/foam space covering the modem.
3	Remove the modem, power cord, and user's manual from the carton.
4	Save the packing material for storage or reshipment purposes.
5	Inspect the equipment for any possible damage incurred during shipment. **Note:** If damage is evident, contact the carrier and Comtech EF Data immediately and submit a damage report.
6	Check the contents against the packing list to verify completeness of the shipment.
7	Refer to the sections that follow for further installation instructions.

The Universal Satellite Modem was carefully packaged to avoid damage and should arrive complete with the following items for proper installation:

1. DMD50 Universal Satellite Modem
2. Power Cord, six foot with applicable AC Connector
3. Installation and Operation Manual

IMPORTANT Should the AC power cable connector be of the wrong type for the installation, either the cable or the power connector end should be replaced.

2.2 Installation Requirements

The modem is shipped fully assembled. It does not require removal of the covers for any purpose in installation. . The power supply itself is designed for universal application using from 100 to 240 VAC, 50 to 60 Hz, 1.0A.

WARNING

There are no user-serviceable parts or configuration settings located inside the Chassis. There is a potential shock hazard internally at the power supply module. DO NOT open the Chassis under any circumstances.

CAUTION

Before initially applying power to the unit, it is a good idea to disconnect the transmit output from the operating ground station equipment. This is especially true if the current configuration settings are unknown, where incorrect settings could disrupt existing communications traffic.

CAUTION

The unit contains a Lithium Battery. DANGER OF EXPLOSION exists if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries in accordance with local and national regulations.

2.3 Mounting Considerations

The can be installed within any standard 19 inch equipment cabinet or rack. The unit is a one rack unit (RU) mounting space (1.75 inches) vertically and 19 inches of depth and requires a minimum rack depth of 22 inches for cabling. The rear panel of the DMD50 is designed to have power enter from the left and IF Cabling enter from the right when viewed from the rear of the unit. Data and control cabling can enter from either side based on data interface option. The unit can be placed on a table or suitable surface if required

When mounted in an equipment rack, adequate ventilation must be provided. The ambient temperature in the rack should be between 10° and 35° C, and held constant for best equipment operation. The air available to the rack should be clean and relatively dry. The DMD50 units may be stacked one on top of the other up to a maximum of 10 consecutive units before providing one RU of space for airflow. Demodulator units should not be placed immediately above a high heat or EMF generator to ensure the output signal integrity and proper receive operation.

Do not mount the in an unprotected outdoor location where there is direct contact with rain, snow, wind or sun. The is designed for indoor applications only.

Shielded cables with the shield terminated to the conductive backshells are required in order to meet EMC directives. Cables with insulation flammability ratings of 94 VO or better are required in order to meet low voltage directives.

The unit CANNOT have rack slides mounted to the side of the chassis. Cooling fans are mounted on the right-hand side of the unit.

If the unit is to be mounted in a rack, ensure that there is adequate clearance for ventilation, particularly at the sides. In rack systems where there is high heat dissipation, forced air cooling must be provided by top or bottom mounted fans or blowers. Under no circumstance should the highest internal rack temperature be allowed to exceed 50°C (122°F).

PROPER GROUNDING PROTECTION REQUIRED: The installation instructions require that the integrity of the protective earth must be ensured and that the equipment shall be connected to the protective earth connection at all times. Therefore, it is imperative during installation, configuration, and operation that the user ensures that the unit has been properly grounded using the ground stud provided on the rear panel of the unit.

- **In Finland:** ***"Laite on liitettävä suojamaadoituskoskettimilla varustettuun pistorasiaan."***
- **In Norway:** ***"Apparatet må tilkoples jordet stikkontakt."***
- **In Sweden:** ***"Apparaten skall anslutas till jordat uttag."***

2.4 Initial Configuration Check

The is shipped from the factory with preset factory defaults. Upon initial power-up, a user check should be performed to verify the shipped modem configuration. Refer to Section 4, User Interfaces to locate and verify that the following configuration settings are correct:

Transmit (Tx) and Receive (Rx) Interface types are dependent upon the customer's order.

Implementing Strap Code 26 can set the following modem configuration. Refer to Table D-1 for an explanation and tabular listing of available Strap Codes. The Frequency and Modulator Output Power are set independently of the strap code.

Standard Factory Configuration Settings

Modulator:

Data Rate:	2.048 Mbps
Mode:	Closed Network
Satellite Framing:	None
Scrambler:	V.35 (IESS)
Drop and Insert:	Disabled
Inner FEC:	1/2 Rate Viterbi
Outer FEC:	Disabled
Modulation:	QPSK
Frequency:	70.000000 MHz
Modulator Output Power:	-20 dBm

Demodulator:

Data Rate:	2.048 Mbps
Mode:	Closed Network
Satellite Framing:	None
Scrambler:	V.35 (IESS)
Drop and Insert:	Disabled
Inner FEC:	1/2 Rate Viterbi
Outer FEC:	Disabled
Modulation:	QPSK
Frequency:	70.000000 MHz

To lock up the modem, enter 'IF Loopback Enable' under the Test Menu, or connect a Loopback Cable from J11 to J13 on the rear panel of the modem.

2.5 Modulator Checkout

The following descriptions assume that the unit is installed in a suitable location with prime AC power and supporting equipment available.

2.5.1 Initial Power-Up

Before initial power up of the unit, it is a good idea to disconnect the transmit output from the operating ground station equipment. This is especially true if the current Modulator Configuration Settings are unknown, where incorrect settings could disrupt the existing communications traffic. New units from the factory are normally shipped in a default configuration which includes setting the transmit carrier off.

Turn on the unit by placing the Rear Panel Switch (located above the power entry connector) to the On Position. Upon initial and subsequent power-ups, the Microprocessor will test itself and several of its components before beginning its Main Monitor/Control Program. These power-up diagnostics show no results if successful. If a failure is detected, the Fault LED will illuminate.

The initial field checkout of the modem can be accomplished from the Front Panel or in the Terminal Mode. The Terminal Mode has the advantage of providing full screen access to all of the modem's parameters, but requires a separate terminal or computer running a Terminal Program. The Terminal Mode is enabled from the front panel in the System M&C Submenus.

2.5.2 Factory Terminal Setup

The factory terminal setup is as follows:

Emulation Type:	VT-100 (can be changed)
Baud Rate:	19.2 K (Can be changed via Front Panel)
Data Bits:	8
Parity:	No Parity (Fixed)
Stop Bits:	1 Stop Bit

Chapter 3. Theory of Operation

3.1 Modem Hardware

The modem is based on a two printed circuit card (minimum configuration) design with additional optioned printed circuit cards available for additional features. The minimum configuration consists of an L-Band/IF Assembly and a Digital Baseband Assembly. The optional printed circuit cards include a Turbo Codec printed circuit card and one of several types of Interface printed circuit card (refer to Appendix A). A block diagram of the DMD50 is shown in Figure 3-1.

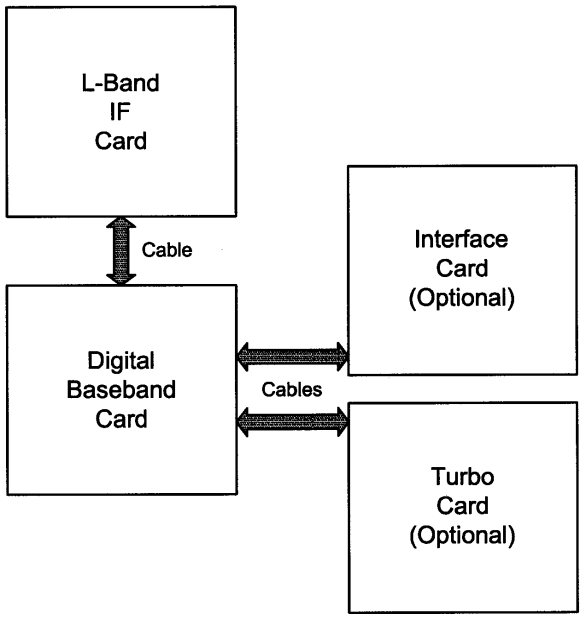


Figure 3-1. Block Diagram

3.1.1 L-Band/IF Printed Circuit Card

The L-Band/IF Printed Circuit Card consists of an analog modulation function, an analog complex downconversion, and two wide-band digital synthesizers. The block diagram of the L-Band/IF Assembly is shown in Figure 3-2.

In the modulator, analog in-phase (I) and quadrature (Q) signals are generated on the Digital Baseband Printed Circuit Card, routed to the L-Band/IF Printed Circuit Card, and modulated at the desired frequency. The L-Band or 70/140 modulated signal is then passed through a microprocessor controlled variable attenuator providing gain control of the output signal. In the complex downconverter, the signal for demodulation is amplified and sent through a variable wideband attenuator for AGC. The gain-controlled signal is then passed through a complex downconverter to a low IF.

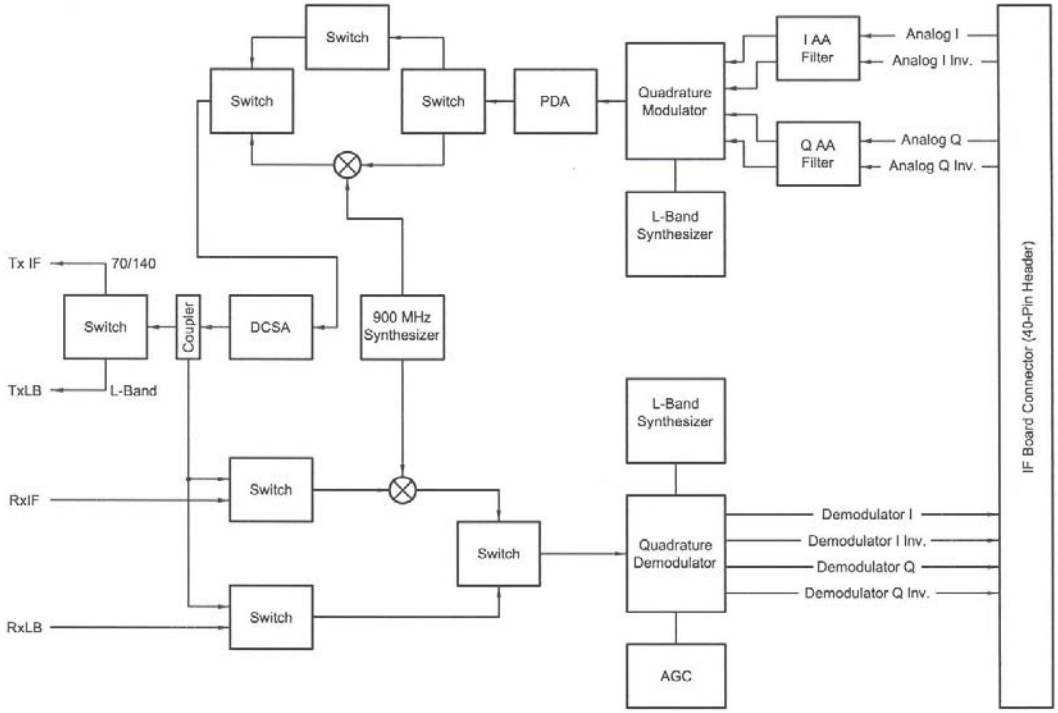


Figure 3-2. IF Card Block Diagram

3.1.2 Baseband Processing Printed Circuit Card

The advent of million-plus gate count FPGAs, advanced logic synthesis tools, and DSPs providing hundreds of MIPs enabled the design of a software configurable modem. Large, fast FPGAs now provide designers with what is essentially an on the fly programmable ASIC. High speed, complex digital logic functions that previously could only be implemented in dedicated integrated circuits are now downloaded from a micro-controller through a serial or peripheral interface. When a new digital logic function is needed, a new configuration file is loaded into the FPGA. There is no limit to the number of digital logic configurations available to the FPGA, aside from the amount of Flash memory available to the system microprocessor for storage of configuration files.

The Baseband Processing Printed Circuit Card provides a flexible architecture that allows many different modes of terrestrial and satellite framing, various FEC options, digital voice processing, and several different modulation/demodulation formats. Also included on the Baseband Printed Circuit Card are three synchronous interfaces, an EIA-530 Interface supporting RS-422, V.35, and RS-232. All three interfaces are provided on the same DB-25 Connector, and are selectable from the front panel.

The Baseband Printed Circuit Card also contains the Monitor and Control (M&C) Circuitry responsible for:

- Programmable part setup and initialization
- Continuous control and adjustment of some functions
- Calibration
- Monitoring fault status
- Calculating and displaying measurements
- User monitor and control interface including front panel and remote
- Units configuration and feature set

The M&C System is based on a powerful microprocessor with a large amount of Flash memory. several bus architectures are used to interconnect the M&C to all components of the DMD50. Communication to the outside world is done via connections to the remote port, terminal port, Ethernet port, and alarm ports. The M&C runs off of software programmed into its Flash memory. the memory can be reprogrammed via the Ethernet port to facilitate changes in software.

3.1.3 Enhanced Interface Printed Circuit Card

The normal terrestrial data for the Baseband Processing Card can be re-routed to the enhanced interface card. The enhanced interface card adds a variety of connections to the modem for additional applications

3.2 Functional Block Diagram

Figure 3-3 represents the Functional Blocks. The modem is shown in a typical application with customer data, Tx/Rx RF equipment and an antenna.

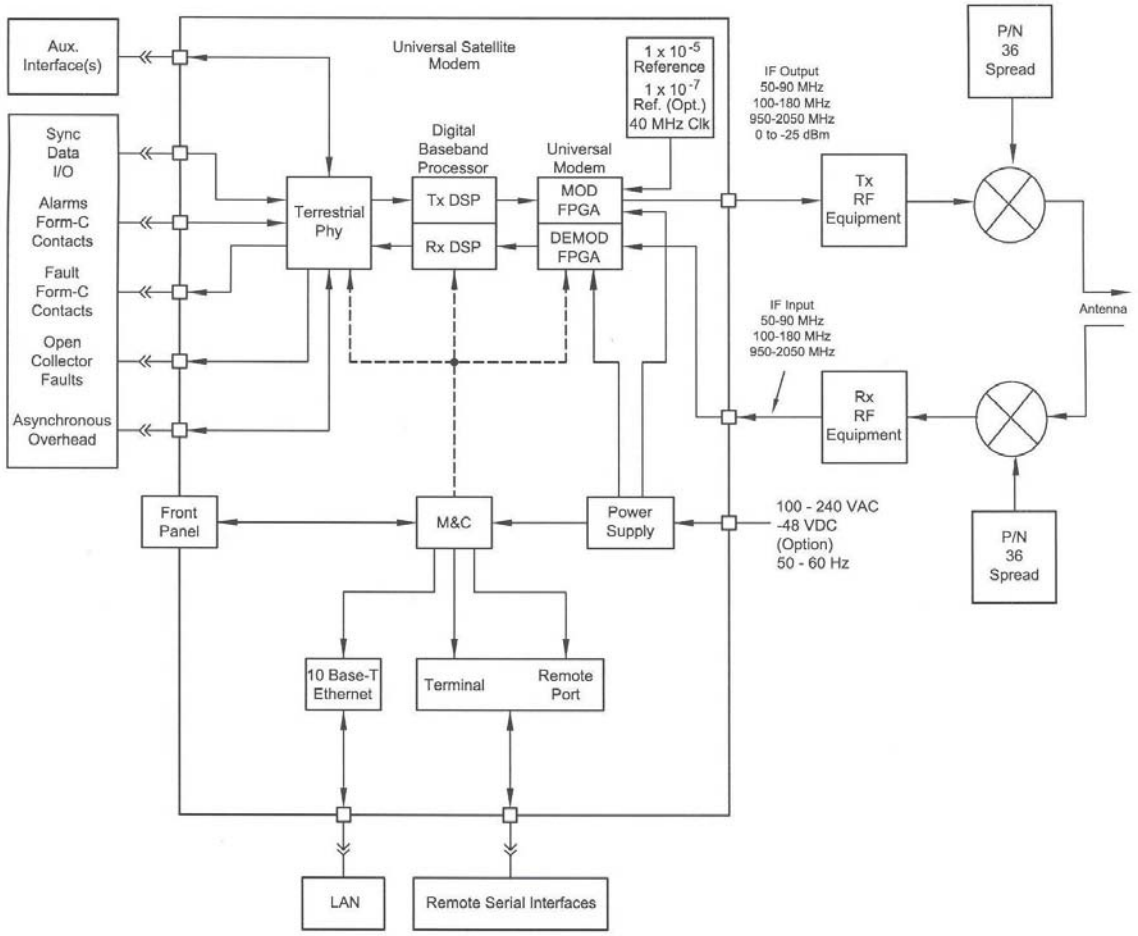


Figure 3-3. Universal Satellite Modem Functional Block Diagram

3.2.1 Front Panel

The Front Panel includes a 2 x 16 backlit LCD Display, Indicator LEDs, and a Numeric Keypad (refer to Chapter 4).

3.2.2 Baseband Processing

The Baseband Processor performs all of the functions required for an IBS/IDR Framing Unit, a Reed-Solomon Codec, and an E1/T1 Drop and Insert System. In addition, the Baseband Processing Section provides for transmit clock selection and rate adaptation as well as a rate adapter and Plesiochronous/Doppler (PD) Buffer in the receive direction. A multiplexer is also provided for the SCT Clock Source for Loop Timing Applications. The transmit and receive paths may be configured independently under processor control.

3.2.3 Tx Baseband Processing

The Tx Data and Clock enters the Baseband Processor, passes through a Rate Adapting FIFO and enters the Framer/Drop Processor. In IDR, IBS, and D&I Modes, the framer adds the appropriate framing and ESC as defined in IESS-308 and 309. In D&I Mode, the framer acquires the terrestrial framing structure, E1 or T1, and synchronizes the Drop Processor. The Drop Processor extracts the desired time slots from the terrestrial data stream and feeds these channels back to the framer. The framer then places the 'dropped' terrestrial time slots into the desired satellite channel slots. The data is then sent to the Reed-Solomon Encoder.

When enabled, the Reed-Solomon Encoder, encodes the data into Reed-Solomon Blocks. The blocks are then interleaved and synchronized to the frame pattern as defined by the selected specification (IESS-308, IESS-309, DVB, etc.). After Reed-Solomon Encoding, the composite data and clock are applied to the BB Loopback Circuit.

3.2.4 Rx Baseband Processing

The Receive Processor performs the inverse function of the Tx Processor. Data received from the satellite passes through the BB Loopback Circuit to the Reed-Solomon Decoder to the Deframer. The Deframer acquires the IBS/IDR/DVB frame, synchronizes the Reed-Solomon Decoder and extracts the received data and overhead from the frame structure, placing the data into the PD Buffer, sending the overhead data to the UIM. The data is extracted from the buffer and is sent to the UIM. Backward Alarm indications are sent to the M&C Subsystem. In Drop and Insert Mode, the Insert Processor synchronizes to the incoming terrestrial T1/E1 Data Stream, extracts satellite channels from the PD Buffer, and then inserts them into the desired terrestrial time slots in the T1/E1 Data Stream.

3.3 Monitor & Control (M&C) Subsystem

The modems M&C system is connected to most of the circuitry on any board contained in the modem. These connections provide status on the working condition of the circuitry as well as providing the data required for the various measurements the modem provides. The M&C processes this information and generates status indications as well as alarms when necessary. Detailed status information is available via the modems various user interfaces including the remote and terminal ports. An external summary fault is available on the RS422 Data interface

The M&C contains a high-performance microprocessor and is responsible for overall command and control of modem functions. The M&C is constantly monitoring all subsystems of the modem by performing a periodic poll routine and configures the modem by responding to commands input to the system. During each poll cycle, the status of each of the subsystems is collected and reported to each of the external ports. Performance statistics such as Eb/No, buffer fill %, etc. are compiled. If faults are detected, the M&C will take appropriate actions to minimize the effect of such faults on the system (refer to the Fault Matrices in Chapter 6).

The modem supports the following M&C protocols:

- Terminal Interface (Section 3.2.1)
- Remote Port Interface (Section 3.2.2)
- Ethernet M&C, Web Browser & SNMP (Section 3.2.3)
- Modem Status, Alarms & Contact Closures (Section 3.2.4)

3.3.1 Terminal Port

This port supports an asynchronous control protocol as described in Section 4. It is configured to support RS-232 signal levels. This port is intended for use in computer-based remote M&C. All functions of the modem may be monitored and controlled from this port via a common terminal connected to the Terminal Port. This function is front panel selectable.

The Terminal Mode Control allows the use of an external terminal or computer to monitor and control the modem from a full screen interactive presentation operated by the modem itself. No external software is required other than VT-100 Terminal Emulation Software (e.g. "Procomm" for a computer when used as a terminal. The Control Port is normally used as an RS–232 Connection to the terminal device. The RS-232 operating parameters can be set using the modem Front Panel and stored in Non-volatile memory for future use.

Refer to the Remote Protocol Manual (TM117) for the Terminal, Remote and SNMP screens and protocols.

3.3.2 Modem Remote Communications (RLLP)

The Remote Port located on J20 allows for control and monitoring of parameters and functions via an RS-232 Serial Interface, or RS-485 for RLLP Protocol. 'Equipment Remote Mode' setup can be entered from the front panel or the Web Browser interface under the "System" menu. This requires the user to first set the Remote Port Control to "Remote" then set the Multidrop Address as needed followed by setting the Remote Interface to RS232 or RS485.

Control and status messages are conveyed between the modem and all subsidiary modems and the host computer using packetized message blocks in accordance with a proprietary communications specification. This communication is handled by the Radyne Link Level Protocol (RLLP), which serves as a protocol 'wrapper' for the RM&C data. Complete information on monitor and control software is contained in the following sections.

3.3.3 Ethernet M&C Port

This port is dedicated for Ethernet Communications supporting SNMP, FTP and Web Browser. The port is configured for 10 Base-T communications protocols. The Ethernet M&C Interface requires a standard RJ45 Male connector. Refer to Appendix D and F for proper setup of the TCP-IP interface and Web Browser Setup.

3.3.4 Modem Monitor Status

The modems M&C system is connected to most of the circuitry on any board contained in the chassis. These connections provide status on the working condition of the circuitry as well as providing the data required for the various measurements the modem provides. The M&C processes this information and generates status indications as well as alarms when necessary. Detailed status information is available via the modems various user interfaces (front panel, remote and terminal). A summary of this information can be connected to external equipment, switches or alarms via the open collector and/or form-C fault connections

Form-C Contacts:

The UIM provides three Form-C Relays under processor control that appear at J15.

Mod Fault: De-energized when any transmit side fault is detected.

Demod Fault: De-energized when any receive side fault is detected.

Common Fault: De-energized when any fault that is not explicitly a Tx or Rx Fault such as an M&C or Power Supply Fault.

Open Collector Faults:

The UIM provides two Open Collector Faults that appear at Pins 18 & 21 on J19.

Mod Fault: Will sink up to 20 ma (maximum) until a transmit or common fault is detected. Will not sink current if a fault is detected.

Demod Fault: Will sink up to 20 ma (maximum) until a receive or common fault is detected. Will not sink current if a fault is detected.

The open collector faults are intended for use in redundancy switch applications in order to provide quick status indications.

3.4 Async Port / ES-ES Communications

This port is dedicated for ES-ES Communications supported by either RS232 or RS485 signal levels. The baud rate and protocol can be selected from the Front Panel. The port may be configured for a number of communications protocols. Overhead data to/from the UIM is routed to/from the framer/deframer. This port is also used by SCC Framing for the in-band data.

3.5 Internal Clock

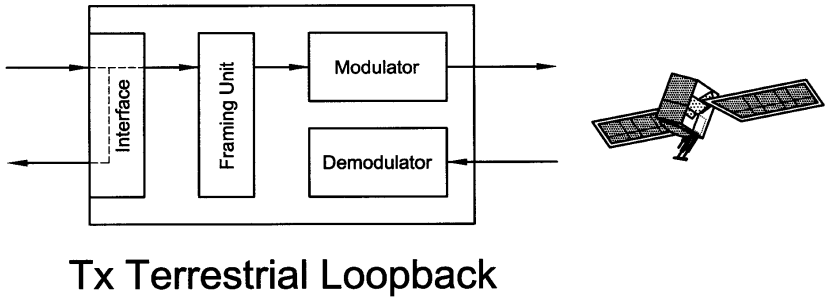
The time and date is kept in order to ‘time-tag’ system events. User can change the Internal Clock via the front panel, Web Browser or Terminal ports.

3.6 Loopback Features (Terrestrial & IF)

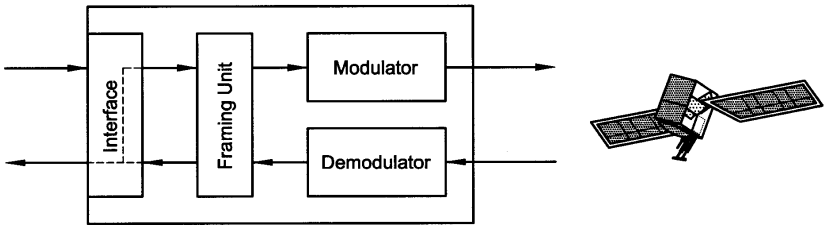
The modem provides for a number of different loopbacks. The Loopback supported are:

- IF Loopback – Tx IF port is looped back to the Rx IF port
- TX Terrestrial Loopback - Tx Data port is looped back to the Rx Data port after the interface driver/receiver. (prior to the framing unit)
- TX Baseband Loopback - Tx Data port is looped back to the Rx Data port after the interface driver/receiver. (after the fraiming unit)
- RX Terrestrail Loopback - Receive Data from the satellite is looped back for retransmission to the satellite, providing a far end loopback. (prior to the framing unit)
- RX Baseband Loopback - Receive Data from the satellite is looped back for retransmission to the satellite, providing a far end loopback. (after to framing unit)
- TX/RX Terrestrial Loopback - provides both Terrestrail loopbacks simultaneously
- TX/RX Baseband Loopback - provides both Baseband loopbacks simultaneously

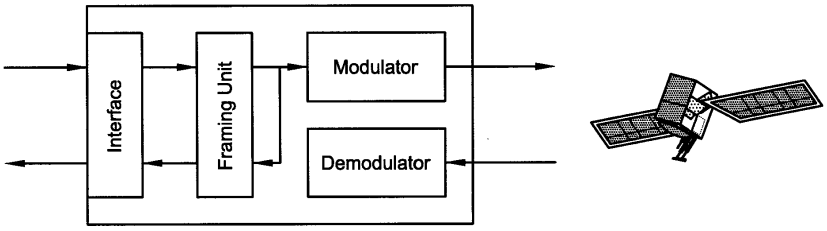
Usage of the modems loopback capabilities in conjunction with the Ethernet data interface can produce undersirable network loops. In order to run any type of data test with an Ethernet interface you must utilize two modems connected back to back. Simply using one modem and a loopback will not produce the desired results.



Tx Terrestrial Loopback



Rx Terrestrial Loopback



Tx Baseband Loopback

Figure 3-4. Loopback Functional Block Diagram

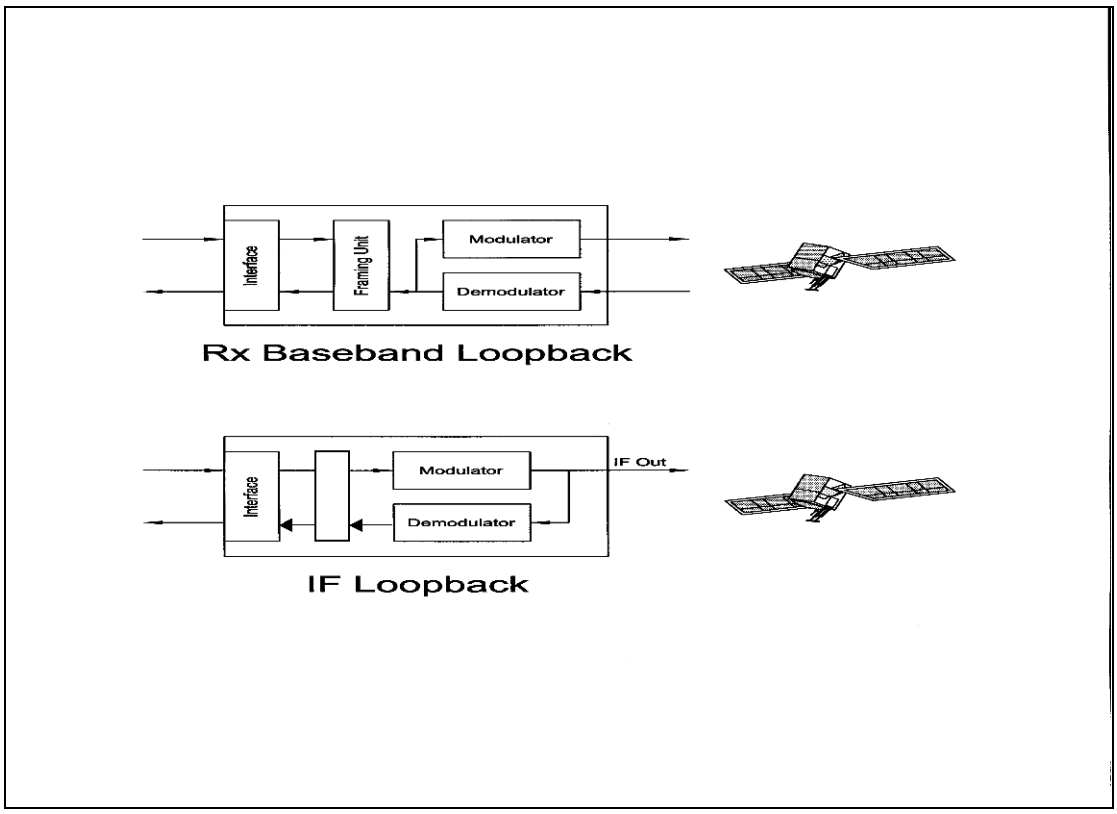


Figure 3-5. Loopback Functional Block Diagram

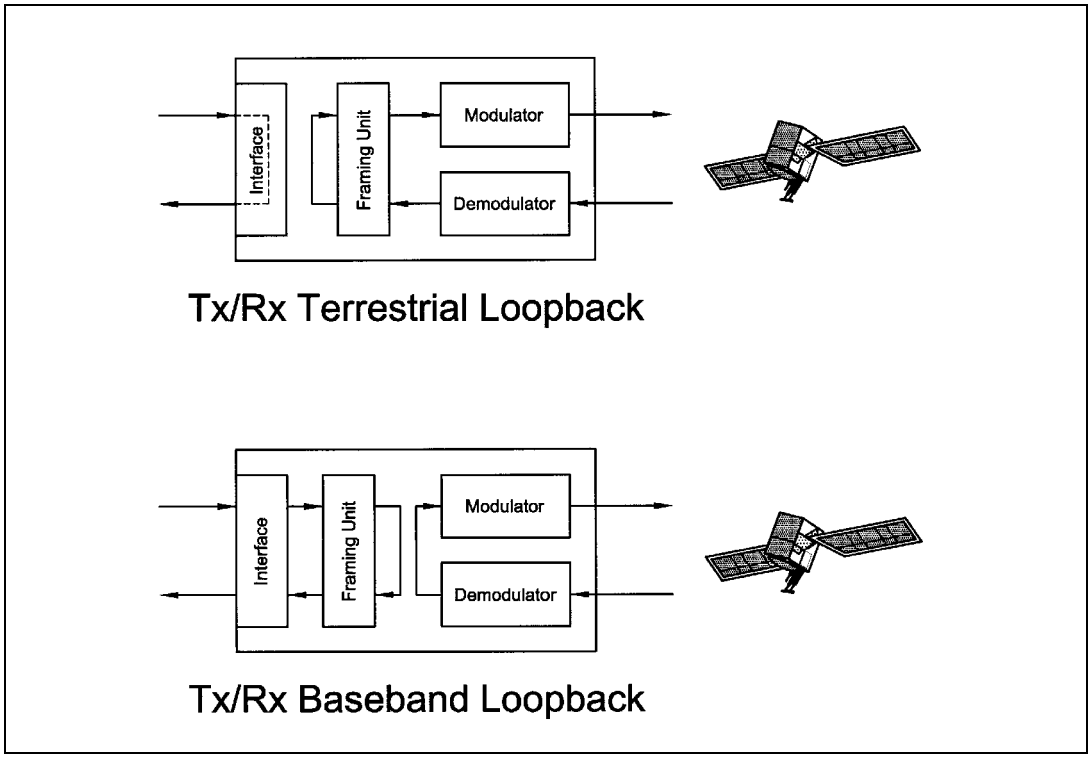


Figure 3-6. Loopback Functional Block Diagram

3.7 Clocking Options

The modem supports a number of different clocking options that can be recovered from the satellite or the terrestrial links. The various clocking options allow users to determine which clock will best fit their applications. Figure 3-7 gives an overview on how the modem processes the various clocks for the Tx Clock source and the Rx Buffer Clock source. Tx and Rx Clocks may be independently locked.

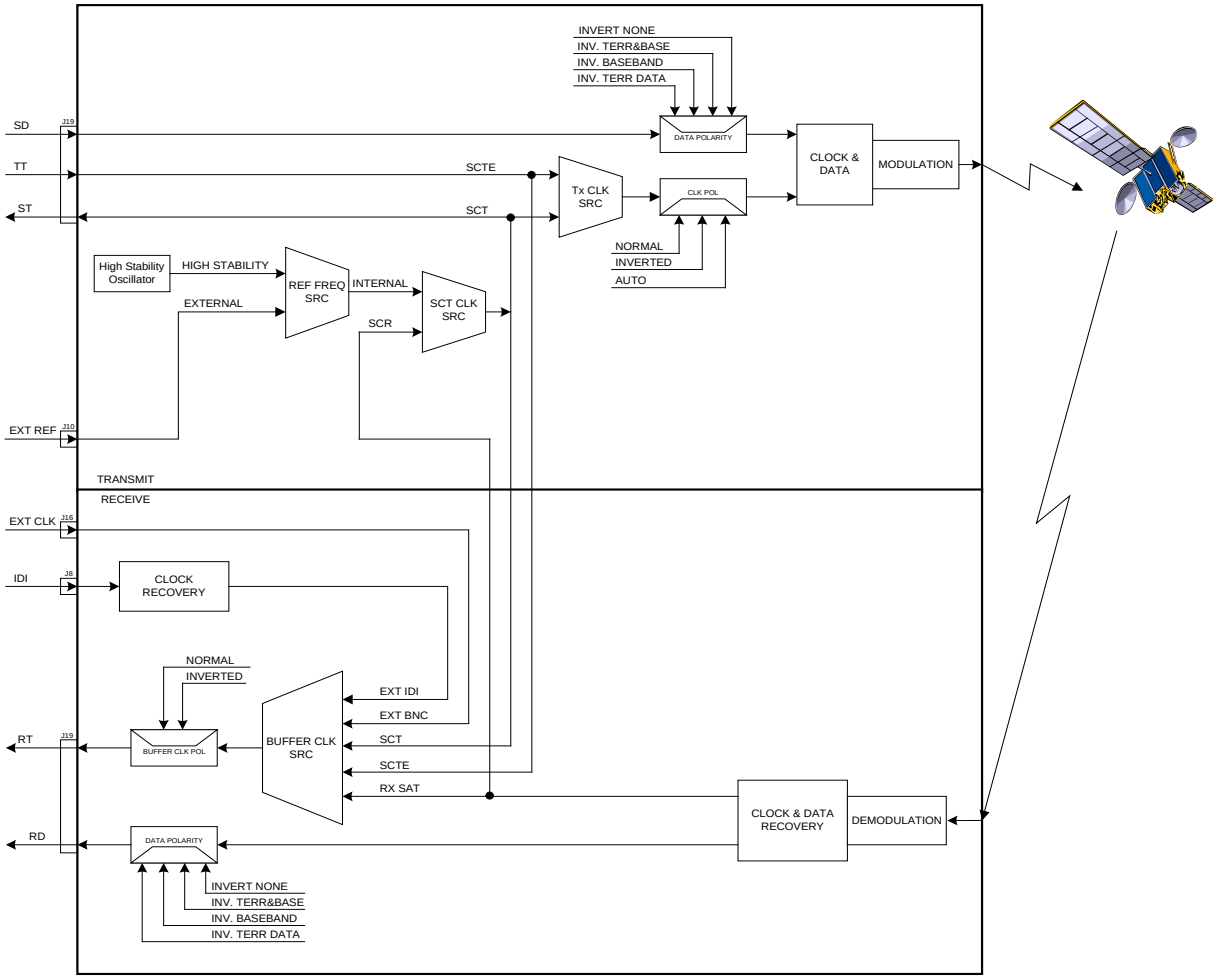


Figure 3-7. Clocking and Polarity Diagram

3.7.1 TX Clock Options

TX clock options can be recovered from the terrestrial interface, satellite interface or internally generated. The allows users to select SCTE Clock (Terrestrial) or the SCT internal clock. The modem also allows user to recover the SCT Clock from the satellite (SCR) or from the modem internally. The modem allows users to select clock polarity. The Tx clock selections available are:

The following paragraphs define the types of clocking options available to the user at the Front Panel.

- SCT (Internal Oscillator)
- SCTE (External Tx Terrestrial Clock)
- Rx Satellite Clock

3.7.1.1 SCTE: Serial Clock Transmit External

The SCTE clock is the Transmit Terrestrial Clock associated with the data interface. SCTE is an external clock received from the terrestrial equipment and the modem utilizes the terrestrial clock to lock the internal clock.

In Figure 3-9, the Transmit Terrestrial Data enters the modem and is clocked into a dejitter FIFO. Data is clocked out of the FIFO by the Modulator Clock. The Modulator Clock and Phase-Locked Loop (PLL), in conjunction with the Dejitter FIFO, which reduces the input jitter. Jitter reduction exceeds the jitter transfer specified in CCITT G.821.

SCTE is sometimes referred to as Tx Terrestrial Timing or Terminal Timing. Terminal Timing is reference to the RS422 synchronous interfaces.

3.7.1.2 SCT: Serial Clock Transmit

The SCT clock can be generated internally or recovered from the satellite. The SCT clock source can be used as the TX clock source, RX Buffer Clock source and the Terrestrial Terminal equipment for clocking the transmit data. If the SCT clock is recovered from the satellite, then it is referred to as SCR. SCR is also referred to as Receive Clock, Satellite Clock, or Receive Timing (RT).

When SCT clock is configured as Internal, the frequency of the clock is set the same as the Transmit Terrestrial Clock rate. If SCT clock is configured as SCR, the internal clock is set to the same rate as the incoming receive satellite clock. SCT is sometimes referred to as Internal Timing or Send Timing (ST). In the event that the satellite clock is lost, the modem will automatically switch over to the Internal Clock and revert back to SCR when activity is detected.

If SCT is selected, then Terrestrial data that is synchronous to the SCT Clock is required to be supplied by the modem. It is intended for the terminal equipment to use the SCT as its clock source. The Autophase Circuit will automatically ensure that the data is clocked correctly into the modem. Therefore, a return clock is not necessary. The Clock Polarity should be set to Auto.

3.7.2 RX Buffer Clock Options

The modem supports a number of RX Buffer clock options that can be recovered from the satellite, terrestrial links, internally or externally. The various clocking options allow users to determine which clock will best fit their applications. Figure 3-7 gives an overview on how the modem processes the various clocks for the Tx Clock and the Rx Buffer Clock. The modem allows users to select clock polarity Tx and Rx Clocks may be independently locked. The following RX Buffer clock selections are available:

- Rx Satellite Clock (Recovered from Satellite)
- SCTE (External Tx Terrestrial Clock)
- SCT (Internal Oscillator)

- EXC Clock/EXT BNC (External Clock Source)
- EXT IDI (Drop and Insert)

The modem handles RX Buffer clock selections based on source priority levels. The user assigns priorities to the clock sources based on source selections. Source 1 has the highest priority and Source 5 being the last resort or lowest priority. If a fallback clock is selected and activity is lost at the highest priority source, the modem will fall back to the next highest priority clock with activity. When activity resumes on a higher priority source, the modem resumes using the higher priority source

Clock Source		Priority	
RX SAT	1	of	5
SCTE	2	of	5
SCT	3	of	5
EXC BNC	4	of	5
EXT IDI	5	of	5

Refer to Front panel setup menus or Web Browser manual MN-DMDREMOTEOP

3.7.2.1 RX SAT Clock

The RX Sat clock is recovered from the satellite that is received from the distant end. If selected the Buffer Clock is lock to the RX sat clock.

3.7.2.2 SCTE: Serial Clock Transmit External

When SCTE is selected as the Rx Buffer clock, the modem receives the clock from the Transmit Terrestrial interface.

3.7.2.3 SCT: Serial Clock Transmit

If SCT clock is selected as the RX Buffer clock source, then it should be configured for internal. SCT is sometimes referred to as Internal Timing or Send Timing (ST).

3.7.2.4 EXT CLK/EXT BNC: External Clock, J16

The External Clock that can be selected as the RX Buffer clock source. This is a 75ohm unbalanced BNC connector. This clock source is also identified as EXT BNC. The External Clock is often used as the station master clock. The RX Clock selection can be accessed in the INTERFACE/RX SETUP menu. The clock frequency, EXT FREQ can be selected, in the Interface/General Menu.

Clock specification:

Frequency:	1 MHz to 20 MHz
Level:	0.3 Vp-p to 5 Vp-p (Sine or Square wave)

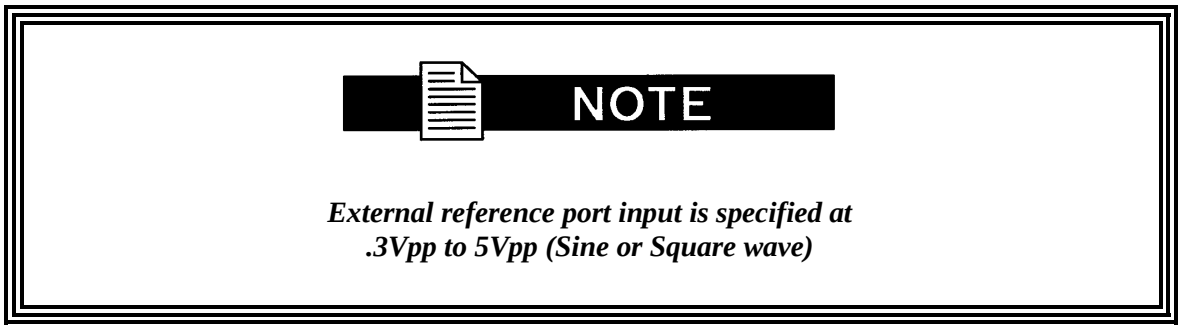
3.7.2.5 EXT IDI: Insert Data In

External IDI is used only for E1/T1 Drop and Insert applications. The available T1/E1 Frame Source selections are External, Internal, and IDI/DDO Loopback. The T1/E1 Frame Source selections can be accessed in the INTERFACE/RX SETUP menus. If Ext IDI is selected as the RX Buffer clock, then user must first specify T1/E1 Frame Source.

- External (RX Buffer Clock recovered from the data)
- Internal (RX Buffer Clock recoverd from the internal clock)
- IDI/DDO Loopback (RX Buffer Clock recoverd from the data and looped back)

3.7.3 EXT REF: External Reference, Top BNC Port, J10

This is not actually a clock, but does have some clocking implications. When the external reference is used, the master oscillator within the modem is locked to the external reference, and the internal accuracy and stability of the unit assumes that of the External Reference. Therefore, not only are the transmit frequencies locked to the external reference, but the modem's internal SCT Oscillator is locked to the external reference as well.



3.8 RS530/422/V.35 Interface (Standard)

Data must be clocked into the modem by either the SCTE or SCT Source. If SCTE is selected as the Tx Clock Source, then SCTE must be supplied to the modem on the EIA-530 port. The output of the dejitter buffer will be clocked with this source. SCT should be used if SCTE has excessive jitter.

3.8.1 G.703 Interface (Optional)

If the G.703 Interface is selected, then the Tx Clock Source will default to SCTE and the Clock Polarity will default to Auto.

Loop timing with a G.703 Interface or Asymmetrical Data Rates requires external equipment at the remote end that is capable of using the recovered RD Clock as source timing for (SCTE) SD. The modem will not manipulate the clock frequency. Therefore, the transmit and receive clock rates must be equal in order for the modem to perform loop timing.

3.8.2 HSSI Interface (Optional)

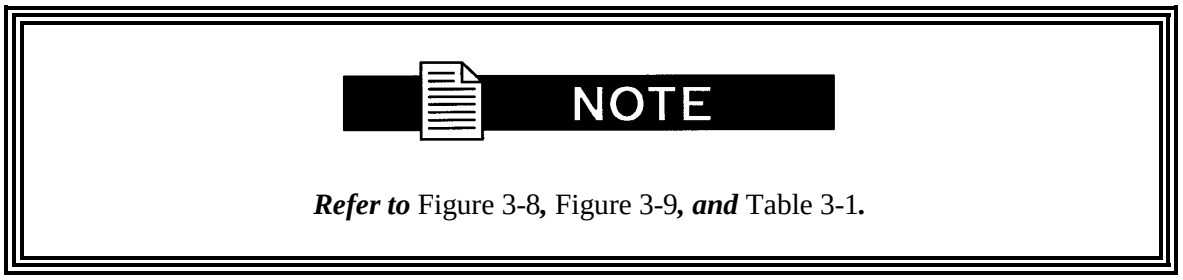
If the HSSI Interface is selected, then the Tx Clock Source will default to SCTE and the Clock Polarity will default to Auto.

3.8.3 Ethernet Data Interface (Optional)

If the Ethernet Data Interface is selected, then the Tx Clock Source will default to SCTE and the Clock Polarity will default to Normal.

If the Ethernet Data Interface is selected, then the Buffer Clock will default to RxSat and the Buffer Clock Polarity will default to Normal.

3.9 Reed-Solomon Codec



Utilizing a Reed-Solomon (R-S) Outer Codec concatenated with a Convolutional Inner Codec is an effective way to produce very low error rates even for poor signal-to-noise ratios while requiring only a small increase in transmission bandwidth. Typically, concatenating an R-S Codec requires an increase in transmission bandwidth of only 9 – 12% while producing a greater than 2 dB improvement in E_b/N_o. R-S is a block Codec where K data bytes are fed into the encoder which adds 2t = (N – K) check bytes to produce an N byte R-S block. The R-S decoder can then correct up to "t" erred bytes in the block.

3.9.1 Reed-Solomon Operation

When the Reed-Solomon Codec is enabled, data is fed to the R-S Encoding Section where it is scrambled, formed into blocks, R-S encoded, and interleaved. Unique words are added so that the blocks can be reformed in the Receiving Modem (Refer to Figure 3-8 and Figure 3-9). Data is then sent to the modulator where it is convolutionally encoded, modulated and transmitted to the satellite.

When the signal is received and demodulated by the Receiving Modem, it is fed to a Viterbi Decoder for the first layer of error correction. After error correction is performed by the Viterbi Decoder, the unique words are located and the data is deinterleaved and reformed into blocks. The R-S Decoder then corrects the leftover errors in each block. The data is then descrambled and output from the R-S Section.

3.9.2 Reed-Solomon Code Rate

The R-S Code Rate is defined by (N, K) where N is the total R-S block size in bytes - data + check bytes - and K is the number of data bytes input into the R-S Encoder. The transmission rate expansion required by the R-S Codec is then defined by N/K. The modem automatically sets the correct R-S code rate for IDR/IBS open network operation in accordance with the data shown in Table 3-1. The modem allows the following N and K setting: (126, 112), (219, 201), (194, 178), (225, 205).

Variable Reed-Solomon rates are available on the optional AS/5167 Super Card. Refer to Appendix A for further information.

3.9.3 Interleaving

Iinterleaving depths of 4, 8, or 12 R-S blocks are allowed. This allows burst errors to be spread over multiple blocks in order to enhance the error correcting performance of the R-S Codec. For Intelsat Network Modes, the interleaving depth is automatically set to 4 for QPSK or BPSK, or 8 for 8PSK. In Closed Network Mode, the interleaver depth can be manually set to 4 or 8, and in DVB Network Mode, the interleaver depth is automatically set to 12.

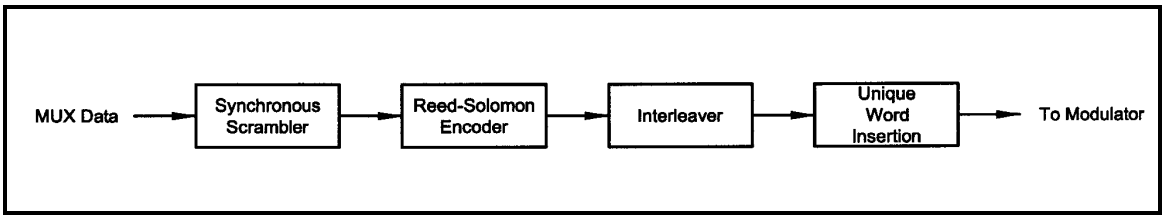


Figure 3-8. Reed-Solomon Encoder Functional Block Diagram

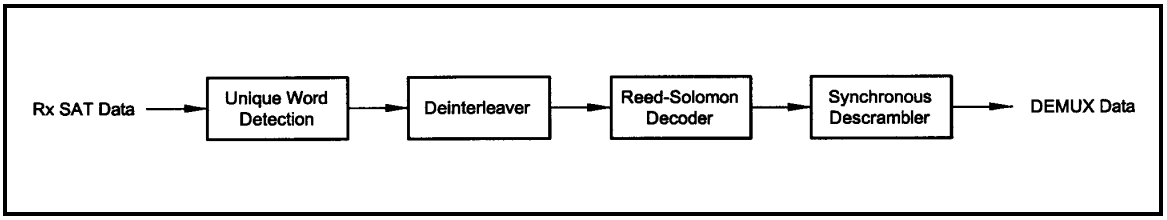


Figure 3-9. Reed-Solomon Decoder Functional Block Diagram

Table 3-1. Reed-Solomon Codes

Type of Service	Data Rate (Kbps)	R-S Code (n, k, t) [1]	Bandwidth Expansion [(n/k) - 1]	Interleaving Depth	Maximum [2] R-S Codec Delay (ms)
Small IDR (With 16/15 O/H)	64	(126, 112, 7)	0.125	4	115
	128	(126, 112, 7)	0.125	4	58
	256	(126, 112, 7)	0.125	4	29
	384	(126, 112, 7)	0.125	4	19
	512	(126, 112, 7)	0.125	4	15
	768	(126, 112, 7)	0.125	4	10

	1024 1536	(126, 112, 7) (126, 112, 7)	0.125 0.125	4 4	8 5
IDR (With 96 Kbps O/H)	1544 2048 6312 8448	(225, 205,10) (219, 201, 9) (194, 178, 8) (194, 178, 8)	0.0976 0.0896 0.0899 0.0899	4 4 4 4	9 7 2 <2
8PSK	1544 2048 6312 8448	(219, 201, 9) (219, 201, 9) (219, 201, 9) (219, 201, 9)	0.0896 0.0896 0.0896 0.0896	8 8 8 8	18 13 4 3
DVB	All	(204, 188, 8)	0.0851	12	-
1. n = code length, k = information symbols and t = symbol error correcting capability. ***2. Design objective.***					

3.10 Asynchronous Overhead Operation (Framing/Multiplexer Capability)

The Asynchronous Framing/Multiplexer is capable of multiplexing a relatively low-speed overhead channel onto the terrestrial data stream resulting in a slightly higher combined or aggregate data rate through the modem. The overhead channel is recovered at the far end. This added channel is termed variously "An Overhead Channel", "Service Channel", "Async Channel" or in IESS terminology an "ES to ES Data Channel." The basic frame structure used by the multiplexer is that specified in the IESS-309 Standard, resulting in a 16/15 Aggregate ratio of overhead & data to data rates.

For Regular Async: (Standard IBS), the Baud Rate is approximately 1/2000 of the Data Rate listed in Table 3-3.

For Enhanced Async: (IBS Async.), the Baud Rate is selectable, but Data Rate is limited.

The maximum Baud Rate is 19,200 bps for IBS Async. Two software-controlled modes are designed into the card to best utilize the available bits; "Standard IBS" and "IBS (Async)". The characteristics of the Channel Interface is also determined by the standard or Async mode.

The Async Channel can be set under software-control to either RS-232 or RS-485 mode. The pin assignments for both modes are shown in Table 5-3.

The "RS-485" Setting controls the output into tri-state when the modem is not transmitting data, allowing multiple modem outputs to be connected together.

Table 3-2. Baud Rate Examples for Standard IBS and Enhanced Mode

Kbps	Baud Rate Example for Standard IBS	Kbps	Baud Rate Example for Enhanced Mode
128	64	9.6	300
256	128	19.2	600
384	192	32	600
512	256	64	1200
640	320	128	2400
768	384	192	4800

Kbps	Baud Rate Example for Standard IBS	Kbps	Baud Rate Example for Enhanced Mode
896	448	256	4800
1024	512	320	9600
1152	576	384	9600
1280	640	448	9600
1408	704	512	9600
1536	768	576	9600
1664	832	640	19200
1792	896	704	19200
1920	960	768	19200
1920	960	768	19200
2048	1024	832	19200
		896	19200
		960	19200
		1024	19200
		1088	19200
		1152	19200
		1216	19200
		1280	19200
		1344	19200
		1408	19200
		1472	19200
		1536	19200
		1600	19200
		1664	19200
		1728	19200
		1792	19200
		1856	19200
		1920	19200
		1984	19200
		2048	19200

3.11 Standard IBS Mode

In the first or "Normal" mode, all bit assignments are per the IBS standard. The bits of Overhead Housekeeping byte 32 are implemented as shown in Table 3-3 below:

Table 3-3. Bits of Overhead Housekeeping

Bit 1	ES to ES Data Channel	This bit is routed directly to the ES to ES Data Channel. Its data rate is $1/512^{th}$ of the aggregate rate (or $1/480^{th}$ of the through terrestrial data rate), and is normally used to super-sample an asynchronous data channel.
Bit 2	Frame Alignment	Part of the Frame Alignment word.
Bit 3	Backward Alarm	Transmit and Receive with main processor to activate Main Alarm/LED.

Bit 4	Multiframe Message	As per IBS.
Bits 5 and 6	Spare	Not currently utilized.
Bits 7 and 8	Encryption Utilization	Not currently utilized.

The ratio of the Through Terrestrial Data Channel Rate to the aggregate rate is 15/16. The standard transmit and receive channels of the ES to ES Data Channel in Standard IBS Mode are raw channels operating at the specific bit rate as controlled by the data channel rate, without buffering. In addition, no clocks are provided with this channel. Since it would be rare that the data rate provided was exactly that required for a standard rate device, the only method of communicating using this channel is to allow it to super-sample the user data.

3.12 Asynchronous Multiplexer Mode

Since many of the frame bits in the standard IBS mode are not used, an "Enhanced" Multiplexer Mode has been implemented that can be engaged under software control. Since this mode changes the use of many of the framed non-data bits, this mode is only usable when the DMD50 is at both ends of a link.

In this mode, the overhead signaling bytes 16 and 48 can be used to implement a significantly higher speed ES to ES Data Channel under software control. When implemented, this rate is 16 times that of the normal IBS standard, or 1/30th of the terrestrial data rate (1/32nd of the aggregate rate).

The IBS Async mode MUST be selected for true Asynchronous channel operation to be available.

3.13 ESC Backward Alarms

When running in IDR Mode and if the modem has the ESC Option, there will be four Backward Alarms available for use by the earth stations at each end of the link (both ends must have the ESC option). These alarms are accessed via the ESC ALARMS Port. The four alarms are controlled by four relays, each having a normally open, normally closed, and a common connection. The common connections of these relays (referred to as Backward Alarm Inputs) can be connected to whichever system on the earth station that the user wishes to trigger the backward alarm.

When ground is applied to the Common (Input) Connection of one of these relays, that relay and associated backward alarm will then be in a "no fault" state. When the ground is removed, the relay and the associated Tx Backward Alarm will toggle to the faulted state. When in the faulted

state, the receive end of the link will receive that backward alarm that is initiated at the transmit end of the link.

The user can connect whichever systems on the earth stations that they desire to these Backward Alarms Relays as long as they will supply ground to the Backward Alarm Relay Input in the “no fault” condition and the ground will be removed in the “faulted” condition.

For example: the user could connect the Demod Summary Fault of the modem to the Backward Alarm 1 Input, so that if the demod went into Major Alarm (such as a Carrier Loss), Backward Alarm 1 would be transmitted to the receive end of the link. At the receive end, it would show up as Rx Backward 1 (Receive Backward Alarm 1).

3.13.1 To Disable the ESC Backward Alarms

If the ESC ALARMS Port will not be used and the Backward Alarm Indications are to be disabled, you must connect pins 10, 11, 22 and 23 to pin 1 (gnd) on ESC Alarms port.

3.14 DoubleTalk Carrier-in-Carrier Option

BEFORE ATTEMPTING TO COMMISSION A SATELLITE LINK USING CARRIER-IN-CARRIER, THE USER MUST ENSURE THAT THE LINK IS ROBUST ENOUGH FOR NORMAL OPERATION. ONLY WHEN THIS HAS BEEN DONE – AND ALL SYSTEM ISSUES (E.G., ANTENNA-POINTING, CABLING, TERRESTRIAL INTERFERENCE, SATELLITE INTERFERENCE, ETC.) HAVE BEEN RESOLVED – SHOULD THE USER ATTEMPT THE USE OF CARRIER-IN-CARRIER.

Space segment costs are typically the most significant operating expense for any satellite-based service, having a direct impact on the viability and profitability of the service. For a satellite transponder that has finite resources in terms of bandwidth and power, the leasing costs are determined by bandwidth and power used. Therefore, a satellite circuit should be designed for optimal utilization to use a similar share of transponder bandwidth and power.

The traditional approach to balancing a satellite circuit – once the satellite and earth station parameters are fixed – involves trade-off between modulation and coding. A lower order modulation requires less transponder power while using more bandwidth; conversely, higher order modulation reduces required bandwidth, albeit at a significant increase in power.

Comtech EF Data has added a new dimension to satellite communication optimization: DoubleTalk Carrier-in-Carrier.

3.14.1 What is DoubleTalk Carrier-in-Carrier?

The Radyne DMD50 DoubleTalk Carrier-in-Carrier option utilizes a patented (US 6,859,641) signal processing algorithm developed by Applied Signal Technology, Inc. that allows both the forward and reverse carriers of a full duplex link to share the same segment of transponder bandwidth, using patented "Adaptive Cancellation." Applied Signal uses the term DoubleTalk™, and Comtech EF Data refers to it as DoubleTalk Carrier-in-Carrier (CnC).

CnC was first introduced in Comtech EF Data products in the CDM-Qx Satellite Modem and, more recently, in the CLO-10 Link Optimizer.

The implementation of DoubleTalk Carrier-in-Carrier in the Radyne DMD50 has been further refined, and some of the limitations that existed in the CDM-Qx implementation have been overcome.

This innovative technology provides a significant improvement in bandwidth and power utilization, beyond what is possible with FEC and modulation alone, allowing users to achieve unprecedented savings. When combined with advanced modulation and FEC, it allows for multi-dimensional optimization:

- Reduced operating expense (OPEX) – e.g., Occupied Bandwidth & Transponder Power;
- Reduced capital expenditure (CAPEX) – e.g., Block Up Converter/High-Power Amplifier (BUC/HPA) size and/or antenna size;
- Increased throughput without using additional transponder resources;
- Increased link availability (margin) without using additional transponder resources;
- A combination of any of the above to meet different objectives.

Summary*: When carriers share common bandwidth, up to 50% savings in transponder utilization is possible.*

3.14.2 Application Requirements

The following conditions are necessary in order to operate DoubleTalk Carrier-in-Carrier:

- Link must be full duplex.
- A Radyne DMD50 must be used at the end of the link where the cancellation needs to take place.
- The transponder is operated as Loopback. That is, each end of the link must be able to see a copy of its own signal in the return (downlink) path from the satellite. The looped back signal is then subtracted which leaves the signal from the distant end of the link. **DoubleTalk Carrier-in-Carrier cannot be used in spot beam systems.**
- The transponder needs to be "bent-pipe" – meaning no on-board processing, demodulation, regeneration can be employed. Demodulation/remodulation does not preserve the linear combination of the forward and return signals and the resulting reconstituted waveform prevents recovery of the original constituent signals.

Figure 3-1 shows a simplified conceptual block diagram of CnC processing. The two ends of the link are denoted **A** and **B** and the uplink and downlink are shown.

This performance is achieved through advanced signal processing algorithms that provide superior cancellation while tracking and compensating for the following common link impairments:

1) **Time varying delay:** In addition to the static delays of the electronics and the round-trip delay associated with propagation to the satellite and back, there is a time-varying component due to movement of the satellite. The CnC module tracks and compensates for this variation.
2) **Frequency offset and drift:** Common sources are satellite Doppler shift, up and down converter frequency uncertainties, and other drift associated with the electronics in the Radyne DMD50 itself. The CnC module tracks and compensates for this frequency offset and drift.
3) **Atmospheric effects:** Fading and scintillation can affect amplitude, phase, and spectral composition of the signal and the degree to which it correlates with the original signal. The CnC module tracks and compensates for these atmospheric related impairments.

4) **Link Asymmetries:** Various asymmetries in the forward and return link can produce differences in the relative power of the two received signal components. These can be both deterministic (static) or random (and time varying). An example of the former would be the differences resulting from antenna size/gain variations between the two ends of the link. An example of the latter would be transient power differences due to different levels of atmospheric fading in the uplinks. CnC compensates for the asymmetries, up to a certain extent.

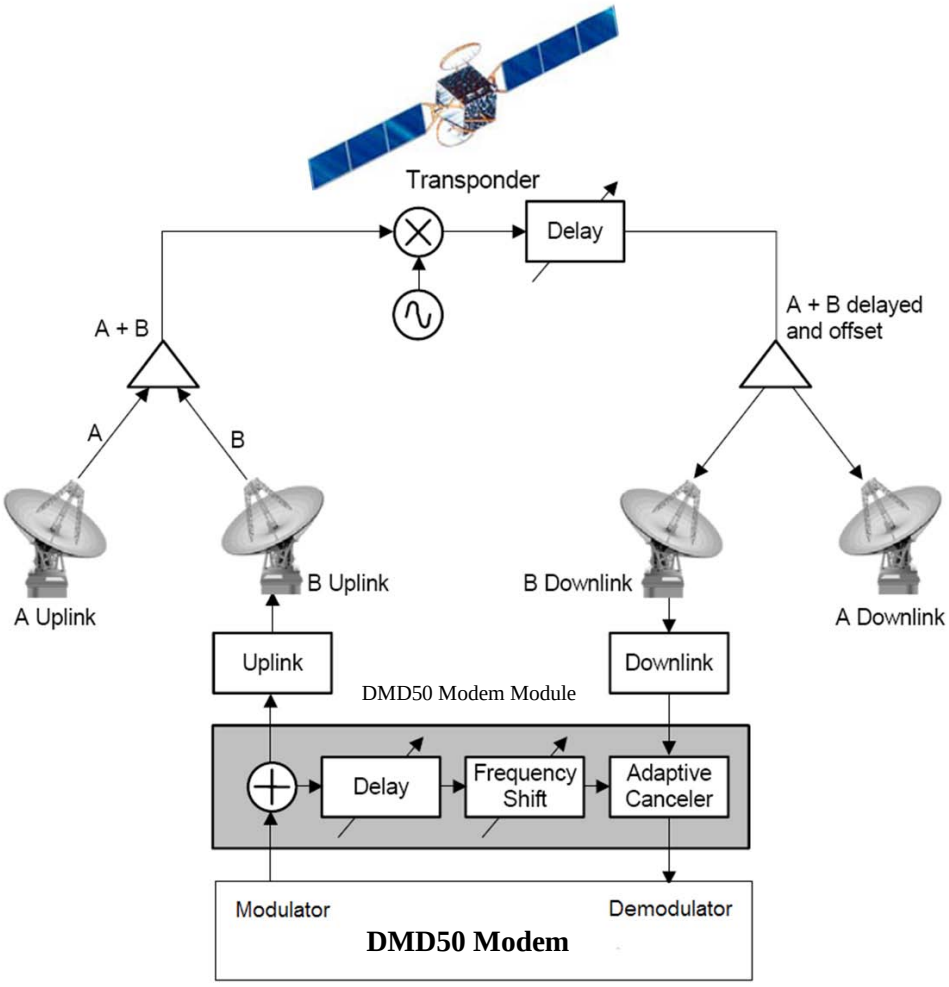


Figure 3-10. Conceptual Block Diagram

In a number of ways, CnC carriers behave similar to conventional carriers in satellite links. They are both exposed to adjacent carriers, cross-polarization and rain fade, and exhibit impairments when any of these become too great. In addition, CnC operates in an environment where:

- Carriers intentionally occupy the same spectral slot;
- Performance depends upon desired and co-located interfering carrier.

3.14.3 Operational Recommendations

The rules for CnC operation are summarized below:

- Both earth stations share the same footprint so each sees both carriers;
- CnC carriers are operated in pairs;
- One outbound with multiple return carriers is not allowed;
- Asymmetric data rates are allowed (no restrictions);
- The ratio of power spectral density is normally less than 11 dB;
- CnC operates with *modems* – **not** *modulators only* or *demodulators only*.

In addition, to minimize 'false' acquisition, observe the following:

- Use of IESS-315 V.35 Scrambler is highly recommended;
- Keep the search delay range as narrow as possible – once the modem has reported the search delay, narrow the search delay range to the nominal reported value +/- 5 ms – for example, if the modem reported delay is 245 ms, narrow the search range to say 240 – 250 ms.
- Use external data source (e.g. Firebird) or internal BER tester when testing Carrier-in-Carrier performance.
- To prevent self-locking in case the desired carrier is lost, it is recommended that the two carriers have some configuration difference – for example, use different settings for Spectrum Inversion.

3.14.4 System Functionality and Operational Considerations

Figure 3-2 illustrates a conventional, full duplex satellite link where two carriers are placed in non-overlapping channels.

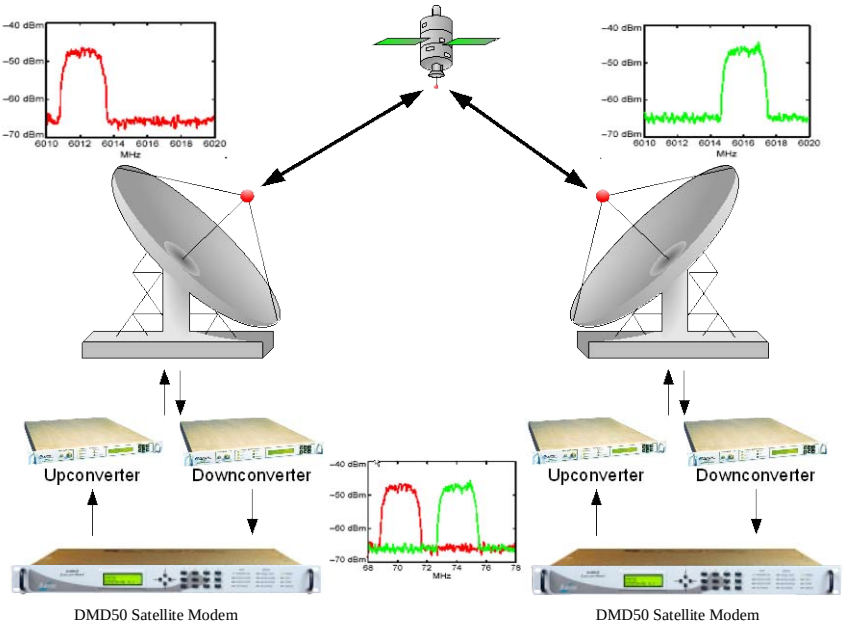


Figure 3-11. Conventional FDMA Link

Figure 3-3 shows the same link using the Radyne DMD50 equipped with the DoubleTalk Carrier-in-Carrier option. Note that now only 50% of the bandwidth is being used, as now both carriers are occupying the same bandwidth.

The transponder downlinks the composite signal containing both carriers on the same band to the Radyne DMD50 which then translates the signal to near baseband where it can be filtered (decimated) and then processed as a complex envelope signal. The Radyne DMD50 then suppresses the version of the near end carrier on the downlink side and then passes the desired carrier to the demodulator for normal processing.

To further illustrate, as shown in **Figure 3-4**, without DoubleTalk Carrier-in-Carrier, the two carriers in a typical full duplex satellite link are adjacent to each other. With DoubleTalk Carrier-in-Carrier, only the composite signal is visible when observed on a spectrum analyzer. Carrier 1 and Carrier 2, shown here for reference only, are overlapping, thus sharing the same spectrum.

The Radyne DMD50 CnC module operates on the near-zero signal before the demodulator, and is waveform agnostic. This means that no prior knowledge of the underlying modulation, FEC, or any other waveform specific parameter is required in order to perform the signal suppression operation. The only caveat to this is that the waveform must be *sufficiently random.*

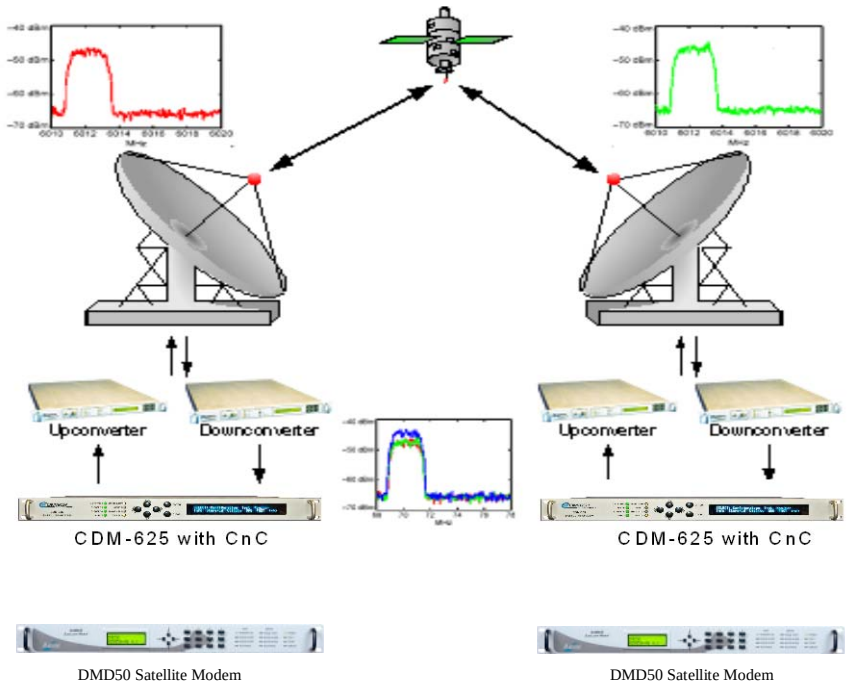
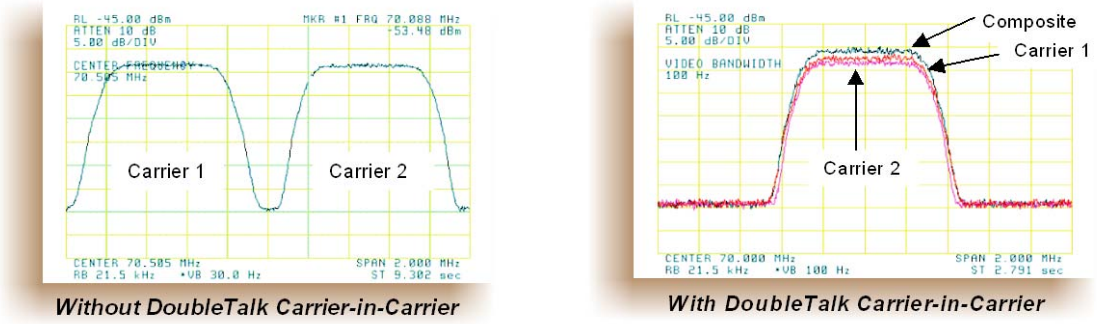


Figure 3-12. Same Link Using Radyne DMD50 and DoubleTalk Carrier-in-Carrier



Traditional Full Duplex Link **Duplex Link with DoubleTalk Carrier-in-Carrier**

Figure 3-13. Duplex Link Optimization

Because acquiring the delay and frequency offset of the interfering carrier is fundamentally a correlation operation, anything deterministic in the interfering carrier (within the correlation window of the algorithm) will potentially produce false correlation peaks and result in incorrect delays and/or frequency. Normally, this is not a problem, since energy dispersal techniques are utilized in the vast majority of commercial and military modems. However, it is something that must be kept in mind when troubleshooting a system that utilizes the DoubleTalk Carrier-in-Carrier technique for signal suppression.

One possible way to mitigate false peaks is to narrow the correlation window. For example, if the delay is known to be around 240ms, set the minimum search delay to 230ms and the maximum search delay to 250ms.

As all advances in modem technologies – including advanced modulation and FEC techniques – approach their theoretical limits of power and bandwidth efficiencies, DoubleTalk Carrier-in-Carrier allows satellite users to achieve spectral efficiencies (bps/Hz) that cannot be achieved

with modulation and FEC alone. **Table 3-1** illustrates how DoubleTalk Carrier-in-Carrier, when used with 16-QAM, approaches the bandwidth efficiency of 256-QAM (8bps/Hz).

Table 3-4. Spectral Efficiency using DoubleTalk Carrier-in-Carrier

Modulation and Code Rate	Spectral Efficiency (bps/Hz)	
	Traditional SCPC	Carrier-in-Carrier
BPSK 1/2	0.50	1.00
QPSK 1/2	1.00	2.00
QPSK 2/3	1.33	2.67
QPSK 3/4	1.50	3.00
QPSK 7/8	1.75	3.50
8-QAM 2/3	2.00	4.00
8-QAM 3/4	2.25	4.50
8-QAM 7/8	2.63	5.25
16-QAM 3/4	3.00	6.00
16-QAM 7/8	3.50	7.00

As shown here, DoubleTalk Carrier-in-Carrier allows equivalent spectral efficiency using a lower order modulation and/or FEC Code Rate; CAPEX is therefore reduced by allowing the use of a smaller BUC/HPA and/or antenna. And, as DoubleTalk Carrier-in-Carrier can be used to save transponder bandwidth and/or transponder power, it can be successfully deployed in bandwidth-limited as well as power-limited scenarios.

3.14.5 DoubleTalk Carrier-in-Carrier Cancellation Process

The state-of-the-art signal processing technology employed via DoubleTalk Carrier-in-Carrier continually estimates and tracks all parametric differences between the local uplink signal and its image within the downlink. Through advanced adaptive filtering and phase locked loop implementations, it dynamically compensates for these differences by appropriately adjusting the delay, frequency, phase and amplitude of the sampled uplink signal, resulting in excellent cancellation performance.

When a full duplex satellite connection is established between two sites, separate satellite channels are allocated for each direction. If both directions transmitted on the same channel, each side would normally find it impossible to extract the desired signal from the aggregate due to interference originating from its local modulator. However since this interference is produced locally, it is possible to estimate and remove its influence prior to demodulation of the data transmitted from the remote location.

For the DoubleTalk Carrier-in-Carrier cancellation, it is necessary to provide each demodulator with a copy of its local modulator's output.

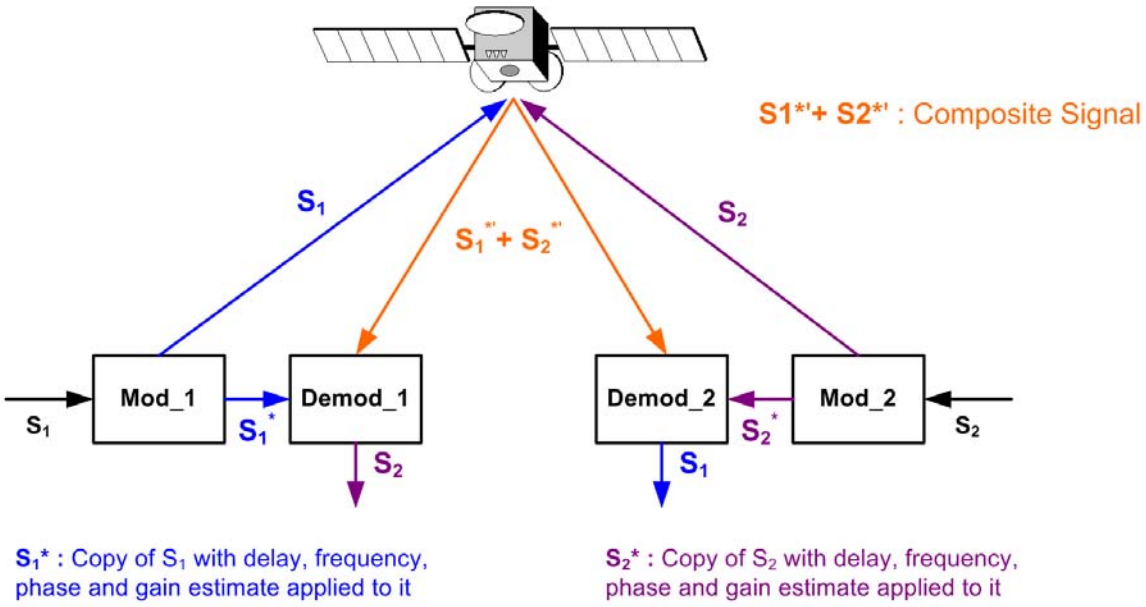


Figure 3-14. DoubleTalk Carrier-in-Carrier Signals

Referring to Figure 3-5: Modem 1 and Modem 2 transmit signals S1 and S2 respectively. The satellite receives, translates, and retransmits the composite signal. The downlink signals S1* and S2*, received at Modem 1 and Modem 2 differ from the transmit signals primarily in terms of phase, frequency, and delay offsets.

Referring to Figure 3-6: For round trip delay estimation, a search algorithm is utilized that correlates the received satellite signal to a stored copy of the local modulator's transmitted signal. The interference cancellation algorithm uses the composite signal and the local copy of S1 to estimate the necessary parameters of scaling (complex gain/phase), delay offset and frequency offset. The algorithm continuously tracks changes in these parameters as they are generally time-varying in a satellite link.

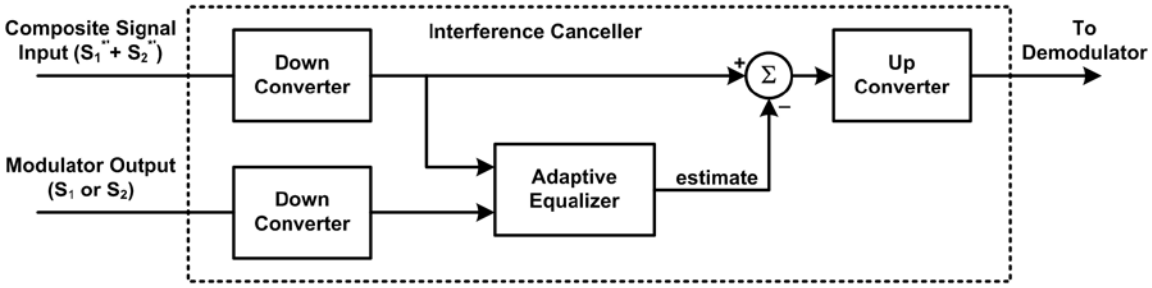


Figure 3-15. Carrier-in-Carrier Signal Processing Block Diagram

The resulting estimate of the unwanted interfering signal is then subtracted from the composite signal. In practical applications, the estimate of the unwanted signal can be extremely accurate. Unwanted interfering signal suppression of 30 dB or more has been achieved in commercial products with minimal degradation of the demodulator performance.

3.14.6 Margin Requirements

Typical interfering signal cancellation is 28 to 35 dB (depending on the product). The residual interfering signal appears as noise causing a slight degradation of the Eb/No. To compensate for the residual noise, a small amount of additional link margin is required to maintain the BER. Margin requirements depend on the product, modulation and power ratios:

For the Radyne DMD50, the additional margin requirements are as follows:

Modulation	Nominal Margin*
BPSK	0.3 dB
QPSK/OQPSK	0.3 dB
8-PSK	0.5 dB
8-QAM	0.4 dB
16-QAM	0.6 dB

* Equal power and equal symbol rate for the interfering carrier and the desired carrier, i.e., 0 dB PSD ratio. Measured at IF with AWGN, +10 dBc Adjacent Carriers, 1.3 spacing.

3.14.7 Carrier-in-Carrier Latency

Carrier-in-Carrier has no measurable impact on circuit latency.

3.14.8 Carrier-in-Carrier and Adaptive Coding and Modulation

Carrier-in-Carrier is fully compatible with VersaFEC Adaptive Coding and Modulation (ACM) mode of operation in the Radyne DMD50.

Carrier-in-Carrier combined with VersaFEC ACM can provide 100 – 200% increase in average throughput.

3.14.9 Carrier-in-Carrier Link Design

Carrier-in-Carrier link design involves finding the FEC and modulation combination that provides optimal bandwidth utilization. Just like conventional link design, it is an iterative process that involves trying different FEC and modulation combinations with Carrier-in-Carrier until an optimal combination is found.

For optimal Carrier-in-Carrier performance, it is recommended that the two carriers have similar symbol rate and power. This can be achieved by selecting appropriate MODCODs as shown in following sections.

3.14.9.1 Symmetric Data Rate Link

Consider the following example:

Satellite & Transponder	Galaxy 18 @ 123° W, 13K/13K
Earth Station 1	Phoenix, AZ – 4.6 m
Earth Station 2	Phoenix, AZ – 2.4 m
Data Rate	512 kbps / 512 kbps

The traditional link was based on QPSK TPC 3/4 and required 0.96 MHz of leased BW. The LST[1] summary for the traditional link is as follows:

Link Analysis Description:

MultiCarrier Txpdr Lease		Link 1	Link 2	
Number of links:	2			
Modulation		QPSK	QPSK	
Information Rate		512.0	512.0	kbit/s
FEC Code Rate		.7500	.7500	
R-S Code Rate		N/A	N/A	
Clear Sky Eb/No Available		9.3	8.7	dB
Number of Assigned Carriers		1	1	
Transmit ES Code		4_6M	2_4M	
Transmit ES Size		4.6	2.4	m
Receive ES Code		2_4M	4_6M	
Receive ES Size		2.4	4.6	m
Receive ES G/T		24.5	29.0	dB/K

Total Leased Resource Usage:

LST calculated			Total BW allocated	.9557	MHz
(MultiCarrier Txpdr Lease)			Total BW PEB	.8208	MHz
Total EIRP utilized	20.1	dBW	Total BW utilized	.9557	MHz
Total EIRP available	20.9	dBW	Total BW available	1.0000	MHz
Margin (available-utilized)	.9	dB	Margin (available-utilized)	.0443	MHz

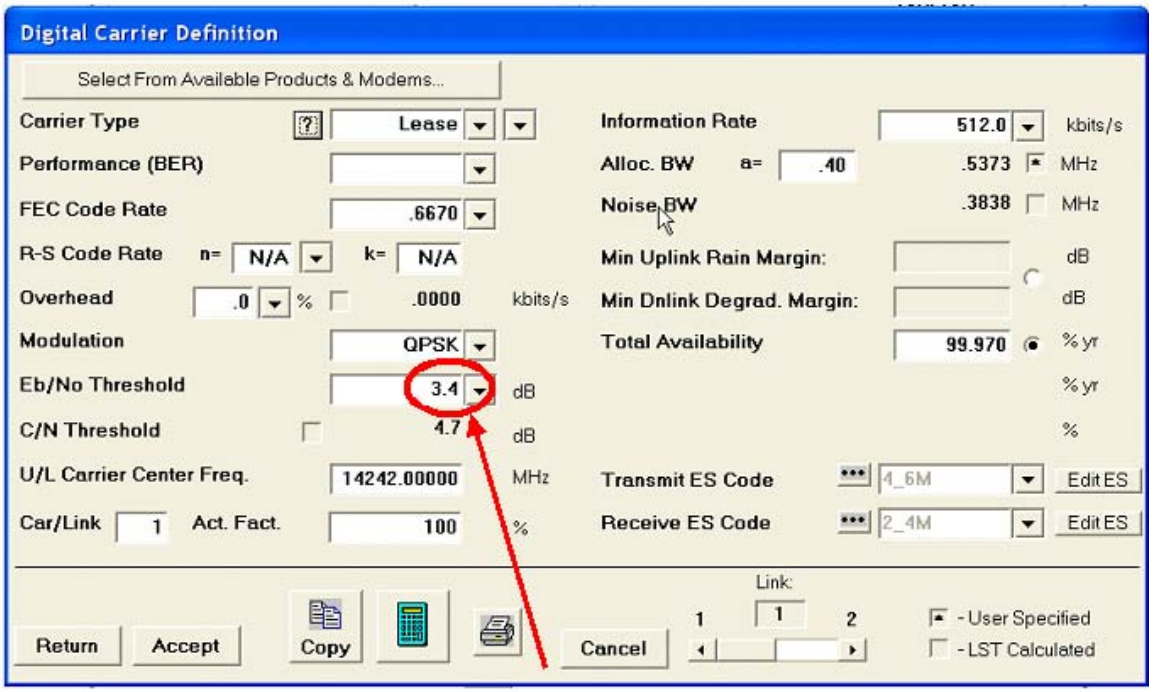
Allocated BW = 0.9557 MHz
PEB = 0.8208 MHz
Leased BW = 0.9557 MHz

Carrier-in-Carrier link design involved trying different Modulation & FEC Code Rates to find the optimal combination:

- 8-QAM, LDPC 2/3 with Carrier-in-Carrier
- QPSK, LDPC 3/4 with Carrier-in-Carrier
- QPSK, LDPC 2/3 with Carrier-in-Carrier
- QPSK, LDPC 1/2 with Carrier-in-Carrier

[1] LST is Intelsat's Lease Transmission Plan Program.

Link parameters and LST summary for QPSK, LDPC 2/3 with Carrier-in-Carrier is as follows:



Includes IF-RF Margin and CnC Margin

Link Analysis Description:			
MultiCarrier Txpdr Lease	Link 1	Link 2	
Number of links: 2			
Modulation	QPSK	QPSK	
Information Rate	512.0	512.0	kbit/s
FEC Code Rate	.6670	.6670	
R-S Code Rate	N/A	N/A	
Clear Sky Eb/No Available	7.9	7.3	dB
Number of Assigned Carriers	1	1	
Transmit ES Code	4_6M	2_4M	
Transmit ES Size	4.6	2.4	m
Receive ES Code	2_4M	4_6M	
Receive ES Size	2.4	4.6	m
Receive ES G/T	24.5	29.0	dB/K

Total Leased Resource Usage:					
LST calculated			Total BW allocated	1.0747	MHz
(MultiCarrier Txpdr Lease)			Total BW PEB	.5777	MHz
Total EIRP utilized	18.6	dBW	Total BW utilized	1.0747	MHz
Total EIRP available	21.4	dBW	Total BW available	1.1000	MHz
Margin (available-utilized)	2.8	dB	Margin (available-utilized)	.0253	MHz

CnC Allocated BW = 1.0747 / 2 = 0.53735 MHz
CnC PEB = 0.5777 MHz
CnC Leased BW = 0.5777 MHz

The link budget summary for the different MODCOD combinations is as follows:

S. No.	Modulation & FEC	Allocated BW (MHz)	PEB (MHz)	Leased BW (MHz)	Savings Compared to Original	PSD Ratio (dB)
1	8-QAM, LDPC 2/3	0.3584	1.1468	1.1468	-20%	2.1
2	QPSK, LDPC 3/4	0.47785	0.6734	0.6734	30%	2.1
3	QPSK, LDPC 2/3	0.53735	0.5777	0.5777	40%	2.1
4	QPSK, LDPC 1/2	0.7168	0.5184	0.7168	25%	2.1

Based on this analysis, QPSK, LDPC 2/3 with Carrier-in-Carrier provides the maximum savings of 40%.

In addition to 40% reduction in Leased Bandwidth, using Carrier-in-Carrier also reduced the required HPA Power by almost 40%:

HPA Power	Traditional Link (QPSK, TPC 3/4)	CnC Link (QPSK, LDPC 2/3)	HPA Power Reduction
HPA @ 4.6 m	0.7 W	0.5 W	40%
HPA @ 2.4 m	1.5 W	1.1 W	36%

3.14.9.2 Asymmetric Data Rate Link

As occupied (or allocated) bandwidth of a Carrier-in-Carrier circuit is dictated by the larger of the two carriers, it is strongly recommended that the smaller carrier be spread as much as possible using a lower order modulation and/or FEC, while meeting the PSD ratio spec. Spreading the smaller carrier using a lower order modulation has multiple benefits:

- Lower order modulation is always more robust;
- Lower order modulation uses less transponder power – this reduces total transponder, and increases available link margin;
- Lower order modulation uses less transmit power on the ground – this can significantly reduce the BUC/SSPA size by not only reducing the transmit EIRP, but also reducing the BUC/SSPA backoff

Consider the following example:

Satellite & Transponder	**IS-901 @ 342º W, 22/22 (EH/EH)**
Earth Station 1	Africa – 4.5 m
Earth Station 2	Africa – 3.0 m
Data Rate	3000 Mbps / 1000 Mbps

While the traditional link was based on QPSK, TPC 3/4 and required 3.9 MHz of leased bandwidth, the Carrier-in-Carrier link was based on QPSK, LDPC 3/4 and QPSK, LDPC 1/2 and required 2.8 MHz of leased bandwidth.

The savings summary is as follows:

Item	Original Link			With Carrier-in-Carrier and LDPC			Savings
	Hub to Remote	Remote To Hub	Total	Hub to Remote	Remote to Hub	Total	
Data Rate (kbps)	3000	1000		3000	1000		
Modulation	QPSK	QPSK		QPSK	QPSK		
FEC	TPC 3/4	TPC 3/4		LDPC 3/4	LDPC 1/2		
Occupied BW (MHZ)	2.8	0.9	3.7	2.8	1.4	2.8	
Power Eq. BW (MHz)	3.3	0.6	3.9	2.5	0.3	2.8	
Leased BW (MHz)			**3.9**			**2.8**	**27.5%**
Hub HPA (W)	26.0			20.3			**22%**
Remote HPA (W)	10.6			6.4			**40%**

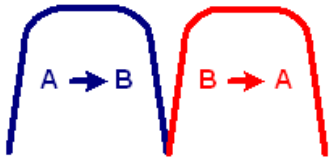
If this link was designed using QPSK, LDPC 3/4 in both directions, it would have required:

Occupied BW	2.8 MHz	
Power Eq. BW	3.0 MHz	7.2% **increase** in Power Eq. BW
Leased BW	3.0 MHz	7.2% **increase i**n Leased BW
Hub HPA	20.3 W	
Remote HPA	8.3 W	30% **increase** in Remote power

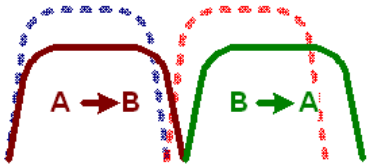
3.14.9.3 Power Limited Links

Carrier-in-Carrier can provide substantial savings even when the original link is power limited. Spreading the carrier by using a lower modulation and/or FEC along with latest FEC such as VersaFEC can substantially reduce the total power which can then be traded with bandwidth using Carrier-in-Carrier. The concept is illustrated with the following examples:

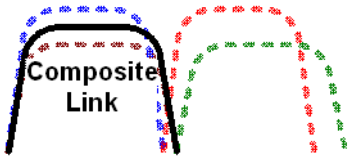
The conventional link is using 8-PSK, TPC 3/4:



Switching to VersaFEC and using a lower order modulation – e.g., QPSK, VersaFEC 0.803 increases the total occupied bandwidth, while reducing the total power equivalent bandwidth:



Now using DoubleTalk Carrier-in-Carrier, the second QPSK, VersaFEC 0.803 carrier can be moved over the first carrier – thereby significantly reducing the total occupied bandwidth and total power equivalent bandwidth when compared to the original side-by-side 8PSK, TPC 3/4 carriers:



To continue, consider this example:

Satellite & Transponder	**IS-901 @ 342° W, 22/22 (EH/EH)**
Earth Station 1	Africa – 9.2 m
Earth Station 2	Africa – 4.5 m
Data Rate	2.048 Mbps / 2.048 Mbps

Whereas the original link used 8-PSK TPC 3/4, the Carrier-in-Carrier link used QPSK VersaFEC 0.803. The savings summary is as follows:

Item	Original Link			With Carrier-in-Carrier and VersaFEC			Savings
	Hub to Remote	Remote To Hub	Total	Hub to Remote	Remote to Hub	Total	
Data Rate (kbps)	2048	2048		2048	2048		
Modulation	8-PSK	8-PSK		QPSK	QPSK		
FEC	TPC 3/4	TPC 3/4		0.803	0.803		
Occupied BW (MHZ)	1.3	1.3	2.6	1.8	1.8	1.8	
Power Eq. BW (MHz)	2.2	1.0	3.2	1.1	0.5	1.6	
Leased BW (MHz)			3.2			**1.8**	**44%**
Hub HPA (W)	**5.0**			**2.0**			**60%**
Remote HPA (W)	**11.6**			**4.7**			**60%**

Note: 1 dB HPA BO for QPSK, 2 dB HPA BO for 8-PSK, 1 dB Feed Loss.

Using Carrier-in-Carrier and VersaFEC reduced the leased bandwidth by almost 44% and HPA power by 60%

3.14.10 Carrier-in-Carrier Commissioning and Deployment

Prior to commissioning a Carrier-in-Carrier link, it is critical that the link is fully tested in non Carrier-in-Carrier mode and all system issues including external interference, antenna pointing, cabling, SSPA backoff are resolved. Only after the link is robust, should the user attempt turning on Carrier-in-Carrier.

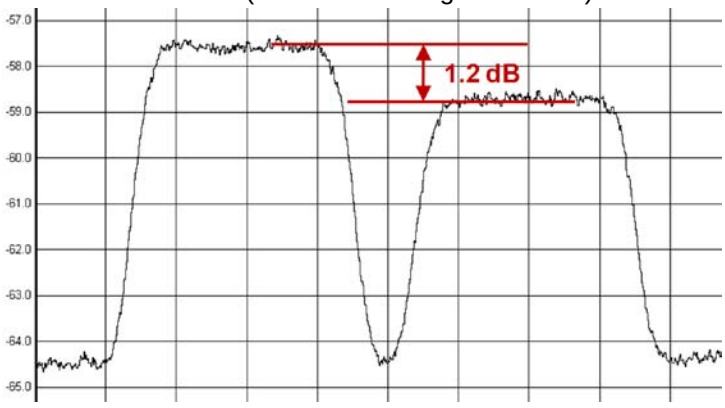
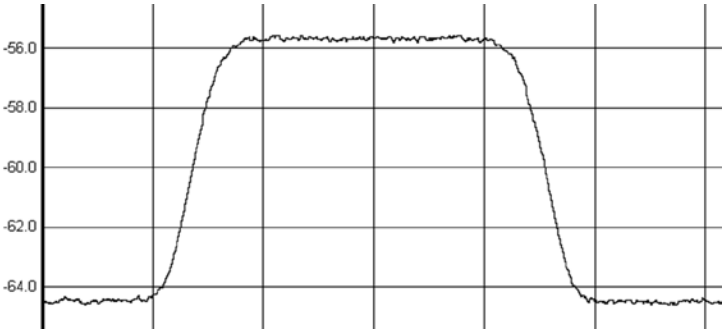
The following procedure is recommended for Carrier-in-Carrier commissioning and deployment:

Step	Procedure
1	Turn ON the carrier at Site A. Carrier from Site B is OFF. CnC function is OFF at both sites. ➢ Using a spectrum analyzer, measure Co+No/No at the input to the modem at Site A. ➢ Using a spectrum analyzer, measure Co+No/No at the input to the modem at Site B. ➢ Measure/record Eb/No at Site B. Make sure there is sufficient margin to account for CnC. ➢ Measure/record Receive Signal Level (RSL) at Site B.
2	Turn OFF the carrier at Site A. Turn ON the carrier at Site B. CnC function is OFF at both sites. ➢ Using a spectrum analyzer, measure Co+No/No at the input to the modem at Site A. ➢ Using a spectrum analyzer, measure Co+No/No at the input to the modem at Site B. ➢ Measure/record Eb/No at Site A. Make sure there is sufficient margin to account for CnC. ➢ Measure/record RSL at Site B.
3	Using Co+No/No readings calculate PSD ratio at Site A and Site B. If it is not within specification, make necessary adjustments to bring it within specification and repeat measurements in Step (1) and (2). ➢ Also verify that the RSL is within spec.
4	Now without changing the transmit power levels, turn ON both the carriers (on the same frequency) and turn CnC ON. ➢ Measure/record Eb/No at Site A and B. ➢ Measure/record RSL at Site A and B. ➢ Now compare Eb/No in presence of 2 over lapping carriers with CnC with Eb/No when only 1 carrier was ON. Eb/No variation should be within spec for that modulation, FEC and PSD ratio.
5	The test can be repeated for different PSD ratio and Eb/No.

3.14.11 Validating Carrier-in-Carrier Performance

Carrier-in-Carrier performance can be easily validated by verifying that Eb/No degradation due to Carrier-in-Carrier is within published specification for the observed Power Spectral Density Ratio.

The following procedure is recommended for validating Carrier-in-Carrier performance:

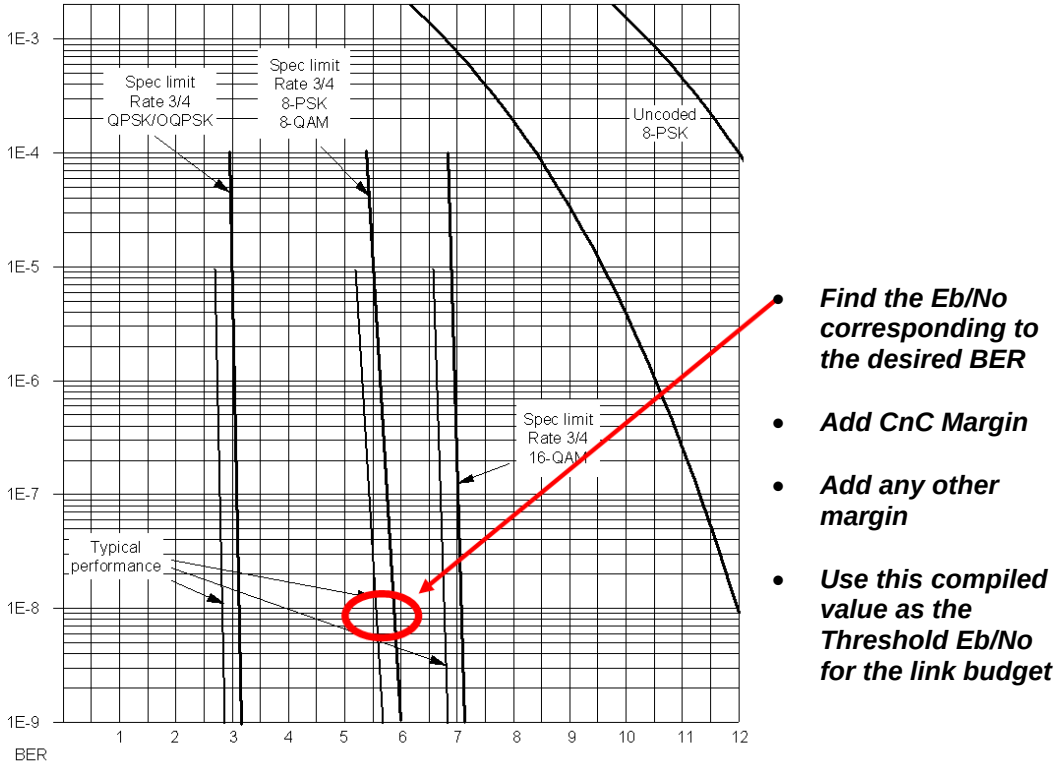
Step	Procedure
1	Setup a conventional side-by-side link of the desired Eb/No: ➢ Carrier-in-Carrier should be OFF. ➢ Record the Eb/No as displayed by the Modems. ➢ Observe the 2 carriers on a spectrum analyzer and record the PSD ratio. **Example Link:** • Full duplex 512 kbps, QPSK, LDPC 2/3 circuit between 4.6 m and 2.4 m antennas • Recorded Eb/No = 2.6 dB (at both modems) • PSD Ratio = 1.2 dB (measured at larger Antenna) 
2	Now relocate one of the carriers on top of the other carrier: ➢ Enable Carrier-in-Carrier. ➢ Record the Eb/No as displayed by the Modems.
3	Calculate change in Eb/No and verify against specification. **Example Link:** • Recorded Eb/No = 2.4 dB • Change in Eb/No = 0.2 dB • Eb/No Degradation (Spec.) at 1.2 dB PSD = 0.3 dB • **Modem performance is within spec.** 

3.14.12 Operational References

3.14.13 Carrier-in-Carrier Link Budget Calculation

The following steps are required for calculating the link budget for a Carrier-in-Carrier Link:

1. Calculate the link budget for both carriers in the duplex link, with required CnC margin:



2. Verify that the PDS ration is within spec for the Radyne DMD50.
3. Calculate the Allocated Bandwidth (BW) and Power Equivalent Bandwidth (PEB) for the duplex link:
   - $BW_{Duplex\ Link}$ = Greater of ($BW_{Carrier\ 1}$, $BW_{Carrier\ 2}$)
   - $PEB_{Duplex\ Link} = PEB_{Carrier\ 1} + PEB_{Carrier\ 2}$
   - Leased $BW_{Duplex\ Link}$ = Greater of ($BW_{Duplex\ Link}$, $PEB_{Duplex\ Link}$)
4. For an optimal link, the Leased Bandwidth and the Power Equivalent Bandwidth should be equal / nearly equal.
5. Repeat the link budget process by selecting different Modulation and FEC, until the BW and PEB is nearly balanced.

3.14.14 Estimating PSD Ratio

PSD can be estimated from a link budget using Downlink EIRP and Symbol Rate:

PSD = Downlink EIRP – 10 * Log (Symbol Rate)

PSD Ratio Example:

Carrier	Downlink EIRP	Symbol Rate	Power Spectral Density
A to B	27 dBW	500 ksps	-29.99 dBW/Hz
B to A	24 dBW	375 ksps	-31.74 dBW/Hz

PSD Ratio (@ A) = -29.99 – (-31.74) = 1.75 dB

PSD Ratio (@ B) = 01.74 – (-29.99) = -1.75 dB

3.14.14.1 Estimating PSD Ratio from LST

Carrier Information	Link 1	Link 2	
Carrier Type	IPL	IPL	
Performance			BER
Modulation	8-Phase	8-Phase	
Eb/No Threshold	5.6	5.6	dB
C/N Threshold	8.6	8.6	dB
Center Frequency	6014.0	6014.0	MHz
Information Rate (IR)	4096.0	4096.0	kbit/s
Overhead (OH)	.0	.0	kbit/s
Data Rate (IR + OH)	4096.0	4096.0	kbit/s
FEC Code Rate	.6667	.6667	
R-S Code Rate	N/A	N/A	
Transmission Rate	6143.7	6143.7	kbit/s
Bandwidths and Margins			
Filter Rolloff Factor	.40	.40	
Allocated Bandwidth	2.8671	2.8671	MHz
Noise Bandwidth	2.0479	2.0479	MHz
Number of Assigned Carriers Per Link	1	1	

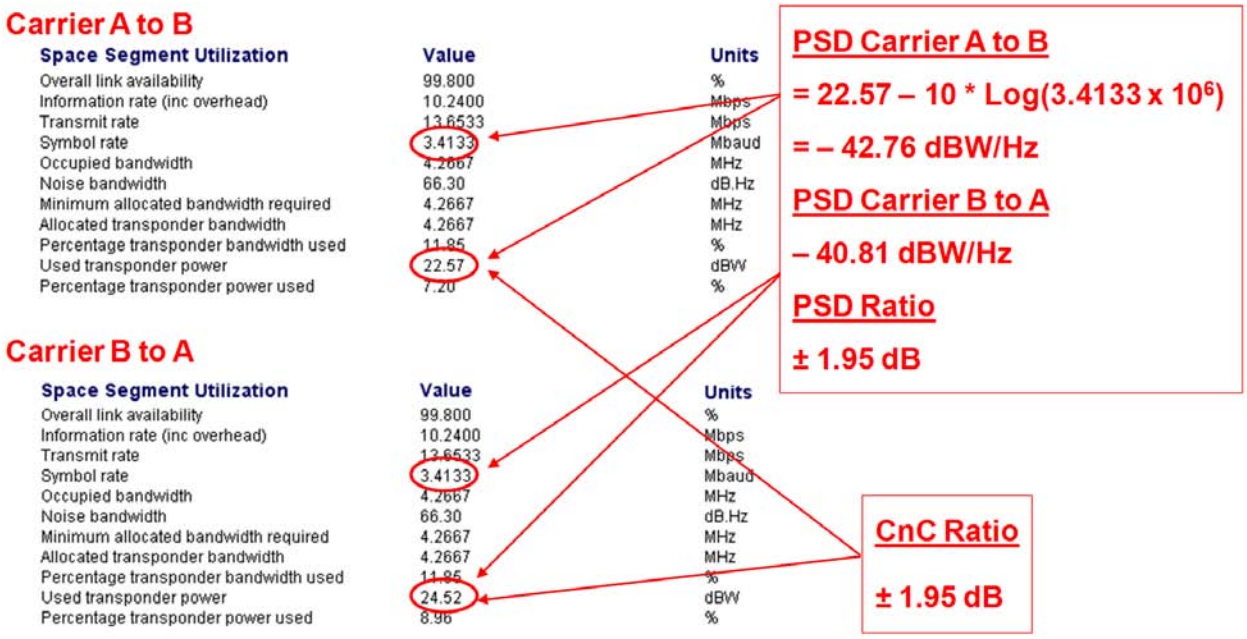
Per Carrier UL & DL eirp (Clr-Sky)	Link 1	Link 2	
Transmit ES elevation angle	70.4	54.5	deg.
Uplink EIRP per carrier	58.7	57.0	dBW
Pathloss at uplink frequency	199.3	199.5	dB
Gain of 1 m2 antenna	37.1	37.1	dBi
Per carrier FD @SC	-103.5	-105.4	dBW/m2
SC pattern advantage @ES	1.8	2.8	dB
Per carrier BE FD arriving @ SC	-101.7	-102.7	dBW/m2
Transponder BE SFD	-79.0	-79.0	dBW/m2
Per carrier input back-off	-22.7	-23.7	dB
Per carrier output back-off	-20.2	-21.2	dB
Transponder BE saturation EIRP	37.0	37.0	dBW
Downlink BE EIRP	16.8	15.8	dBW

PSD Link 1
16.8 – 10 * Log (2.0479 * 1000000) = – 46.3 dBW/Hz

PSD Link 2
15.8 – 10 * Log (2.0479 * 1000000) = – 47.3 dBW/Hz

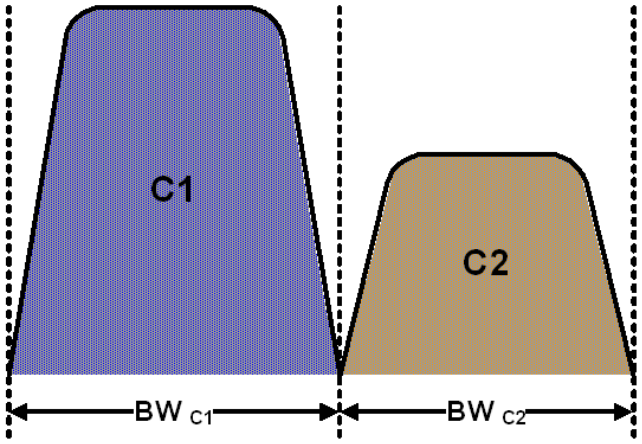
PSD Ratio
± 1.0 dB

3.14.14.2 Estimating PSD Ratio from Satmaster


Carrier A to B
Space Segment Utilization
Value
Units
Overall link availability 99.800 %
Information rate (inc overhead) 10.2400 Mbps
Transmit rate 13.6533 Mbps
Symbol rate 3.4133 Mbaud
Occupied bandwidth 4.2667 MHz
Noise bandwidth 66.30 dB.Hz
Minimum allocated bandwidth required 4.2667 MHz
Allocated transponder bandwidth 4.2667 MHz
Percentage transponder bandwidth used 11.85 %
Used transponder power 22.57 dBW
Percentage transponder power used 7.20 %
Carrier B to A
Space Segment Utilization
Value
Units
Overall link availability 99.800 %
Information rate (inc overhead) 10.2400 Mbps
Transmit rate 13.6533 Mbps
Symbol rate 3.4133 Mbaud
Occupied bandwidth 4.2667 MHz
Noise bandwidth 66.30 dB.Hz
Minimum allocated bandwidth required 4.2667 MHz
Allocated transponder bandwidth 4.2667 MHz
Percentage transponder bandwidth used 11.85 %
Used transponder power 24.52 dBW
Percentage transponder power used 8.96 %
PSD Carrier A to B
= 22.57 – 10 * Log(3.4133 x 10^6)
= – 42.76 dBW/Hz
PSD Carrier B to A
– 40.81 dBW/Hz
PSD Ratio
± 1.95 dB
CnC Ratio
± 1.95 dB

3.14.14.3 Estimating PSD Ratio Using Spectrum Analyzer

PSD Ratio or CnC Ratio can also be estimated using a Spectrum Analyzer capable of integrating the signal power in a given bandwidth.



CnC Ratio (in dB) = $Power_{C1}$ (in dBm) – $Power_{C2}$ (in dBm)

PSD Ratio (in dB) = ($Power_{C1}$ – 10 log BW_{C1} (in Hz)) – ($Power_{C2}$ – 10 log BW_{C2} (in Hz))
= CnC Ratio – 10 log (BW_{C1} / BW_{C2})

If the two carriers have same Symbol Rate / Bandwidth, then the CnC Ratio is same as the PSD Ratio.

3.14.15 DoubleTalk Carrier-in-Carrier Specifications

Operating Mode	Requires the two links to share a common carrier frequency (Outbound and Inbound symbol rates do not have to be equal)
Power Spectral Density Ratio and CnC Ratio	**BSPK/QPSK/8-PSK/8-QAM:** –7 dB to +11 dB (ratio of power spectral density, outbound interferer to desired inbound) **16-QAM:** –7 dB to +7 dB (ratio of power spectral density, outbound interferer to desired inbound) **Note:** With asymmetric carriers the absolute power ratio (or CnC ratio) would be different, depending on the ratio of the symbol rates. **Example:** Outbound interferer = 1 Msymbols/sec Desired Inbound = 500 ksymbols/sec Ratio of power spectral density = +7 dB Absolute power ratio **(CnC Ratio)** = +7dB + (10 log Outbound/desired symbol rate) = +10 dB
Maximum Symbol Rate Ratio	3:1 (TX:RX or RX:TX)
Inbound/Outbound frequency uncertainty	Within the normal acquisition range of the demod, as follows: **Below 32 ksymbols/sec:** ±1 to ± (Rs/2) kHz, where Rs = symbol rate in ksymbols/sec **Between 32 and 389 ksymbols/sec:** ± 1up to a maximum of ± 32kHz **Above 389 ksymbols/sec:** ±1 to ± (0.1Rs) kHz, up to a maximum of ± 200 kHz
Delay range	0-330 ms
Eb/No Degradation (equal Inbound/Outbound power spectral density)	BPSK = 0.3dB QPSK = 0.3dB OQPSK = 0.3dB 8-PSK = 0.5dB 8-QAM = 0.4dB 16-QAM = 0.6dB For +10 dB power spectral density ratio (outbound interferer 10 dB higher than desired inbound) add an additional 0.3 dB
Monitor Functions	Delay, in milliseconds Frequency offset (between outbound interferer and desired inbound). 100 Hz resolution CnC ratio, in dB (ratio of absolute power, outbound interferer to desired inbound)

3.14.16 Carrier-in-Carrier Summary

Comtech EF Data's DoubleTalk Carrier-in-Carrier can provide significant savings in operational expenses. The following should be considered when evaluating DoubleTalk Carrier-in-Carrier:

- DoubleTalk Carrier-in-Carrier can only be used for full duplex links where the transmitting earth station is able to receive itself.
- DoubleTalk Carrier-in-Carrier can be used in both bandwidth limited and power limited situations.
- The maximum savings is generally achieved when the original link is symmetric in data rate.

3.14.17 Glossary

Allocated Bandwidth

Bandwidth or Allocated Bandwidth or Occupied Bandwidth is the frequency space required by a carrier on a transponder.

For example, a Duplex E1 (2.048 Mbps) Circuit with 8-PSK Modulation, FEC Rate 3/4 and 1.4 Spacing requires:

2.548 MHz = 2.048 / (3 * 0.75) * 1.4 * 2

For a 36 MHz transponder, 2.548 MHz corresponds to 7.078% Bandwidth Utilization.

Power Equivalent Bandwidth

Power Equivalent Bandwidth (PEB) is the transponder power used by a carrier, represented as bandwidth equivalent.

PEB Calculation Example:

- Transponder EIRP = 37 dBW
- Output Backoff (OBO) = 4 dB
- Available EIRP = 37 – 4 = 33 dBW = $10^{3.3}$ = 1955.26 Watts
- Transponder Bandwidth = 36 MHz
- Power Available / MHz = 1955.26 / 36 = 54.424 W
- If a carrier uses 24 dBW, its PEB = $10^{2.4}$ / 54.424
  = 4.532 MHz

This corresponds to 12.59% of available transponder power.

Leased bandwidth

Almost all satellite operators charge for the Leased Bandwidth (LBW). Leased Bandwidth or Leased Resource is the greater of the Allocated Bandwidth and Power Equivalent Bandwidth.

For example, if a carrier requires 3 MHz of Allocated BW and 4.5 MHz of PEB, the Leased Bandwidth is 4.5 MHz

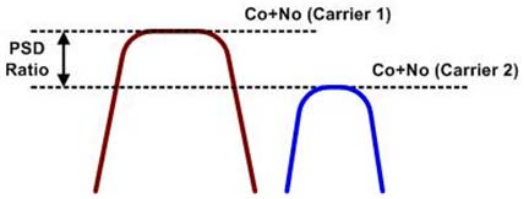
Power Spectral Density (PSD)

Power Spectral Density (PSD) is the signal power per unit bandwidth: **dBW / Hz** *or* **dBm / Hz**

For example: Signal power = 20 dBm
Signal bandwidth = 500 kHz
PSD = 20 – 10 *log (500 * 1000)
= -36.99 dBm / Hz

PSD Ratio

PSD ratio is the ratio of power spectral density of the interfering carrier and the desired carrier. If looking at the 2 carriers side-by-side on a spectrum analyzer:



Eb/No

Ratio of Energy per bit (Eb) to Noise density (No): Unit is dB

C/N

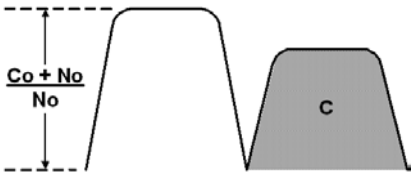
Carrier Power (C) to Noise (N) ratio: Unit is dB

C/No

Carrier Power (C) to Noise Density (N_o) ratio: Unit is dBHz

Co+No/No

Carrier Density (C_o) + Noise (N_o) to Noise Density (N_o) ratio: Unit is dB



$C/N = C/N_o - 10 \log B$ [*where B is bandwidth in Hz*]

$E_b/N_o = C/N_o - 10 \log R$ [*where R is data rate in bits/sec*]

$= C/N + 10 \log B - 10 \log R$

$= C/N - 10 \log$ (Spectral Efficiency)

$E_b/N_o = 10 \log (10^{((Co+No/No)/10)} - 1) - 10 \log$ (Spectral Efficiency)

[*Spectral Efficiency is in bps / Hz*]

3.15 Satellite Control Channel (SCC)

The SCC format uses a variable overhead rate to transmit an asynchronous data channel in addition to the normal data channel. The SCC asynchronous mode implemented on the DMD50 is "PassThru" Mode.

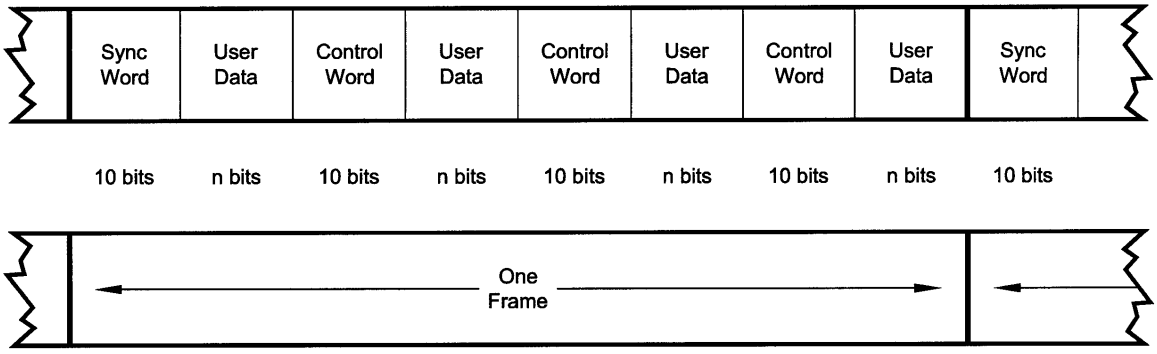
3.15.1 SCC Framing Structure

Each SCC frame consists of the following:

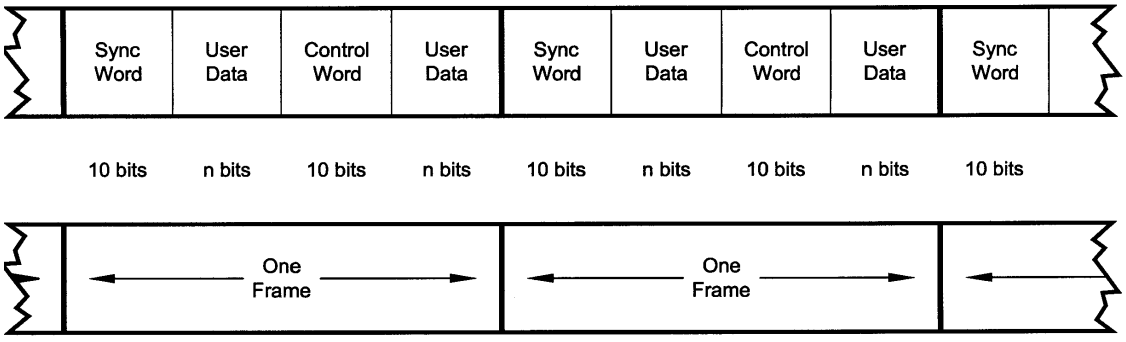
- A 10-bit synchronization pattern called the Synchronizing Word.
- Multiple variable length slots filled with user data.
- Multiple 10-bit control words that contains eight bits of in-band data (the extra two bits are for the async start/stop).

The number of user data slots and control words per frame is selected by the SCC Control Ratio Parameter. This can be any value from 1 to 1 through 1 to 7. A higher ratio allows a lower overhead rate but since there are less Sync Words, there is a higher acquisition time.

The following examples show a control ratio of 1 to 3 and 1 to 1. Example 1 shows three Control Words for every Synchronizing Word, and Example 2 shows one Control Word for every Synchronizing Word.



1 to 3 Control Ratio



1 to 1 Control Ratio

The Control Ratio of the receiving units must match the Control Ratio of the transmitting unit.

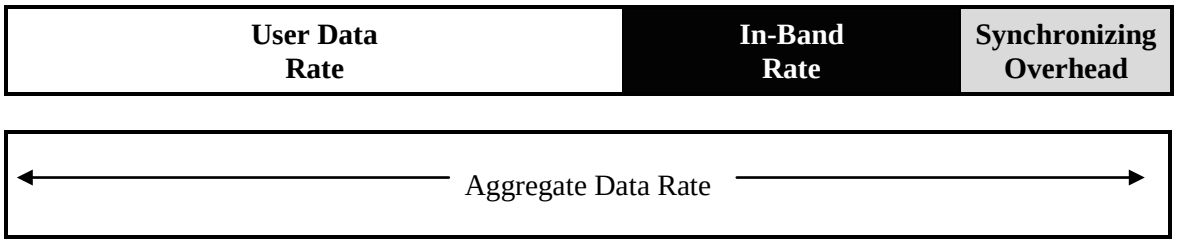
3.15.2 Aggregate Data Rate

The aggregate data rate equals the following:

User Data Rate + In-Band Rate + Synchronizing Overhead Rate

Because SCC must adjust the overhead so that there are an equal number of user data bits in each slot, the synchronizing overhead cannot be easily calculated. However, dividing the In-Band Rate by the Control Ratio can approximate it. The following equation shows the basic calculation of this rate:

Aggregate Date Rate = User Data Rate + In-Band Rate + (In-Band Rate/Control Ratio)



As an example, given the following parameters:

User Data Rate: 1,024,000 bps
In-Band Rate: 19,200 bps
Control Ratio: 1 to 7

Aggregate data rate = 1,024,000 + 19,200 + (19,200/7) or approximately 1,045,942 (actually 1045974).

This gives an overhead ratio of 1,045,974/1,024,000 = 1.021

In addition, another constraint changes the actual Aggregate Data Rate. The user data slot size is limited to 2,500 bits. Because of this, the modem increases the in-band rate to reduce the user data slot size. This only happens at higher user data rates.

3.15.3 Overhead Rate Comparison

The SCC Overhead Ratio varies depending on the User Data Rate, the In-Band Rate, and the Control Ratio. This gives SCC the advantage of lower overhead rates when compared to IBS, which has a fixed overhead ratio of 16/15 or 1.067. Table 3-4 shows example overhead rates for different user data and control ratios.

Table 3-5. Overhead Rates Examples

User Data Rate	In-Band Rate	Control Ratio	Aggregate Data Rate	Overhead Ratio
512,000	19,200	1/7	533,974	1.043
1,024,000	19,200	1/7	1,045,974	1.021
2,048,000	19,200	1/7	2,069,951	1.011

3,072,000	19,200	1/7	3,093,943	1.007
4,096,000	19,200	1/7	4,117,951	1.005
6,312,000	19,200	1/7	6,337,248	1.004
6,312,000	19,200	1/3	6,337,606	1.004
6,312,000	19,200	1/1	6,350,418	1.006

3.15.4 Actual Overhead Rate Calculation

The following is the actual calculation the modem does to calculate the overhead ratio:

1. The modem calculates the minimum in-band rate to limit the size of the user data slots to 2,500 bits (the result is truncated to an integer).

   *Minimum In-Band = (User Data Rate * Control Ratio)/((Control Ratio + 1) * 250)*

2. Using the bigger of Minimum In-Band or the selected In-Band, the modem calculates the number of bits for each user data slot (result is truncated to an integer).

*Slot Bits = (User Data Rate * (Control Ratio * 10))/(In-band Rate * (Control Ratio + 1))*

The actual ratio the modem uses is:

Actual Ratio = (Slot Bits + 10)/Slot Bits

Example 1: User Data Rate: 1,024,000 bps In-Band Rate: 19,200 bps Control Ratio: 1 to 7 Minimum In-Band = (1,024,000 * 7)/((7 + 1) * 250) = 3,584 *(less than In-Band Rate)* Slot Bits = (1,024,000 * (7 * 10))/(19,200 * (7 + 1)) = 466 Actual Ratio = (466 + 10)/466 = 1.021	***Example 2:*** User Data Rate: 6,312,000 bps In-Band Rate: 19,200 bps Control Ratio: 1 to 7 Minimum In-Band = (6,312,000 * 7)/((7 + 1) * 250) = 22,092 (*more than In-Band Rate)* Slot Bits = (6,312,000 * (7 * 10))/(22,092 * (7 + 1)) = 2,500 Actual Ratio = (2,500+ 10)/2,500= 1.004

3.15.5 SCC Overhead Channel Setup

1. Set the Framing Mode (located under Mod and Demod Data Menus) to SCC. After doing this, two new menus will appear to the right of the Framing Menu, for both the Mod and Demod. The new menus will be:

   SCC CTL RATIO
   SCC INBAND RATE

2. Set the desired SCC control ratio:

   SCC CTL RATIO {1/1, 1/2, 1/3, 1/4, 1/5, 1/6, 1/7}

   This allows the user to simulate the framing used by the Satellite Control Channel Option (Pass-Thru Mode only). The SCC CTL RATIO is the ratio of overhead in-band data to synchronizing words.

3. Set the desired SCC in-band rate:

   SCC INBAND RATE {300 to 200000}

   This allows the user to request the rate of in-band data for the overhead channel. This sets the overhead amount only. The actual amount of data that can be passed through the overhead channel will be set under "ES Baud Rate" (see Step 6 below).

4. Under the Interface > General menus, locate the TX ASYNC MODE (menu).

5. Under the TX ASYNC MODE Menu, set the desired ES Interface type:

   ES INTERFACE {RS-232, RS-485}

   This allows the user to select the interface type.

6. Under TX ASYNC MODE Menu, set the desired baud rate for the ASYNC Port (J17). This will be the baud rate that will pass through the overhead channel:

   ES BAUD RATE {150 - 19200}

   This allows the user to select the baud rate of the ASYNC port (J17) in SCC Mode.

7. Under TX ASYNC MODE Menu, set the desired ES BITS/CHAR:

   ES BITS/CHAR {7,8}

   This allows the user to choose between 7 or 8 bits of data.

8. Repeat Steps 4 through 7 under the RX ASYNC MODE (menu)

9. The physical connection to the overhead channel will be the DB-9 Female Port labeled ASYNC (J17).

3.16 EDMAC Satellite Framing/Deframing Mode

The modem supports EDMAC satellite framing. EDMAC can be enables for both modulator and demodulator satellite framing when modem is configured in CLOSED NET applications. EDMAC satellite framing DOES NOT allow control or monitoring of the remote slave modem. On the demodulator, terrestrial date is framed with NULL EDMAC commands, having no effect at the remote demodulator. On the demodulator, EDMAC commands are stripped from the satellite data stream and discarded, leaving the terrestrial data steam intact. EDMAC Framing/Deframing is provided for compatibility purposes only.

3.17 Locating the ID Code Operational Procedure

The modem has unique ID codes that allow the user to add feature upgrades to the modem without the unit having to be returned to the factory. Users are required to identify these ID codes when they want additional features added to their unit. Comtech will supply a new ID code that is required to be entered in the ID code field. Once the new ID code is entered, the modem will activate the new features.

Refer to Appendix B for upgrade procedures.

3.18 Strap Codes

The Strap Code is a quick set key that sets many of the modem parameters. For quick setup of the modem, Strap Codes are very helpful. When a Strap Code is entered, the modem is automatically configured for the code's corresponding data rate, overhead, code rate, framing, scrambler type and modulation. An example of how to set a strap code follows:

Example: In the Ethernet interface <Modulator> Menu, depress the Transmit Gel-tab, then move the cursor down and depress "General". Now move the cursor over to 'Strap Code'. Click inside the box and enter the new strap code submenu and enter #16. The DMD50 will be automatically configured to the parameters shown below in the highlighted row 'Strap Code 16'.

Refer to Appendix D or the various strap code options.

Chapter 4. User Interfaces

4.1 User Interfaces

This section contains information pertaining to the user interfaces for the modem. There are four user intefaces available for the modem. These are:

- Front Panel Interface – Refer to Section 4.2.
- Terminal Interface - :Refer to Section 4.6.
- RS485 Remote Port Interface (RLLP) – Refer to the Section 4.9.
- Ethernet Remote Port Interface (SNMP) – Refer to Section 4.10.
- Ethernet Remote Port Interface (Web Browser) - Refer to Section 4.10.

4.2 Front Panel User Interface

The Front Panel allows for complete control and monitor of all parameters and functions via a keypad, LCD display and status LEDs.

The front panel layout is shown in Figure 4-1, showing the location and labeling of the front panel. The front panel is divided into four functional areas: the LCD Front Panel Display, the Cursor Control Arrow Keys, the Numeric Keypad, and the Front Panel LED Indicators, each described in Table 4-1.

Figure 4-1. Front Panel

Table 4-1. Front Panel Description

Number	Description	Function
1	LCD Front Panel Display	Displays operating parameters and Configuration data
2	Cursor Control Arrow Keys	Controls the up, down, right and left motion of the cursor in the LCD Display window
3	Numeric Keypad	Allows entry of numeric data and Clear and Enter function keys
4	Front Panel LED Indicators	See Paragraph 4.1.4 below for an itemized description of these LEDs

4.2.1 LCD Front Panel Display

The front panel display is a 2 line by 16-character LCD display. The display is lighted and the brightness can be set to increase when the front panel is currently in use.
The LCD display automatically dims after a period of inactivity. The display has two distinct areas showing current information. The upper area shows the current parameter being monitored, such as 'Frequency' or 'Data Rate'. The lower line shows the current value of that parameter. The LCD display is a single entry window into the large matrix of parameters that can be monitored and set from the Front Panel.

4.2.2 Cursor Control Arrow Keys

A set of 'Arrow' or 'Cursor' keys (↑), (↓), (→), (←), is used to navigate the parameter currently being monitored or controlled. Table 4-2 describes the functions available at the Front Panel.

4.2.3 Numeric Keypad

A 10-Key Numeric Keypad with two additional keys for the 'Enter' and 'Clear' function allows the entry of data into the system. Table 4-2 describes the functions available at the Front Panel.

Table 4-2. Edit Mode Key Functions

Edit Mode Key Functions (Front Panel Only)							
Parameter Type	0 – 9	↑	↓	←	→	'Clear' & ←	'Clear' & →
Fixed Point Decimal	Changes Digit	Toggles ± (If Signed)	Toggles ± (If Signed)	Moves Cursor 1 Position Left	Moves Cursor 1 Position Right	N/A	N/A
Unsigned Hexadecimal	Changes Digit	Increments Digit Value	Decrements Digit Value	Moves Cursor 1 Position Left	Moves Cursor 1 Position Right	N/A	N/A
Enumerated	N/A	Previous Value in List	Next Value in List	N/A	N/A	N/A	N/A

Date/ Time	Changes Digit	N/A	N/A	Moves Cursor 1 Position Left	Moves Cursor 1 Position Right	N/A	N/A
IP Address	Changes Digit	Increments Digit Value	Decrements Digit Value	Moves Cursor 1 Position Left	Moves Cursor 1 Position Right	N/A	N/A
Text Strings	Changes Character	Increments Character Value	Decrements Character Value	Moves Cursor 1 Position Left	Moves Cursor 1 Position Right	Clears to Left of Cursor Inclusive	Clears to Right of Cursor Inclusive

4.2.4 Front Panel LED Indicators

Eight LEDs on the Front Panel (Refer to Table 4-3) indicate the status of operation. The LED colors maintain a consistent meaning. Green signifies that the indication is appropriate for normal operation, Yellow means that there is a condition not proper for normal operation, and Red indicates a fault condition that will result in lost communications.

Table 4-3. LED Color Reference

LED	Color	Function
Modem LED Indicators		
Power	Green	Indicates that the unit is turned on.
Fault	Red	Indicates a hardware fault for the unit.
Event	Yellow	Indicates that a condition or event has occurred that the modem has stored in memory. The events may be viewed from the Front Panel or in the Terminal Mode.
Remote	Green	Indicates that the unit is in the process of updating firmware with FTP or flashing indicates some features are demo enabled.
Modulator LED Indicators		
Transmit On	Green	Indicates that the transmitter is on.
Major Alarm	Red	Indicates that the Transmit Direction has failed, losing traffic.
Minor Alarm	Yellow	Indicates that a Transmit Warning Condition exists.
Test Mode	Yellow	Indicates that the transmitter is involved in a current Test Mode activity.
Demodulator LED Indicators		
Signal Lock	Green	Indicates that the receiver locked to an incoming carrier and data, including FEC Sync.

Major Alarm	Red	Indicates that the Receive Direction has failed, losing traffic.
Minor Alarm	Yellow	Indicates that a Receive Warning Condition exists.
Test Mode	Yellow	Indicates that the receiver is involved in a current Test Mode activity.

4.3 Parameter Setup

The four Cursor Control Arrow Keys are used to navigate the menu tree and select the parameter to be set. After arriving at a parameter that needs to be modified, depress <ENTER>. The first space of the modifiable parameter highlights (blinks) and is ready for a new parameter to be entered. After entering the new parameter using the keypad (Refer to Figure 4-2), depress <ENTER> to lock in the new parameter. If a change needs to be made prior to pressing <ENTER>, depress <CLEAR> and the display defaults back to the original parameter. Depress <ENTER> again and re-enter the new parameters followed by <ENTER>.

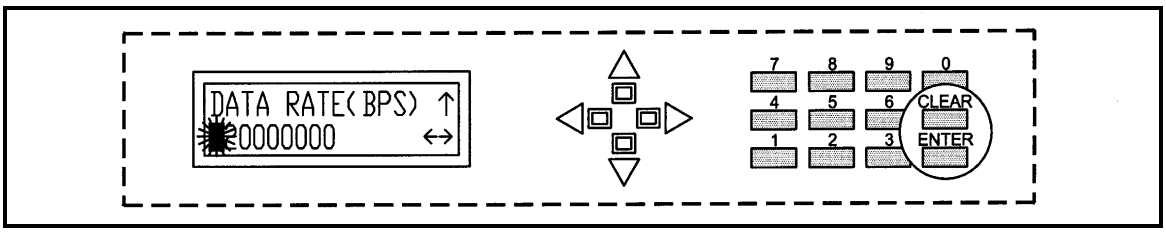


Figure 4-2. Entering New Parameters

Following a valid input, the unit will place the new setting into the nonvolatile EEPROM making it available immediately and available the next time the unit is powered-up.

4.4 Front Panel Control Screen Menus

The Front Panel Control Screens are broken down into sections under several Main Menus.

4.4.1 Main Menus

- MODULATOR
- DEMODULATOR
- INTERFACE
- MONITOR
- ALARMS
- SYSTEM
- TEST

4.4.2 Modulator Menu Options and Parameters

NETWORK SPEC **{IDR, IBS, DROP & INSERT, CLOSED NET, DVB SAT}**

The Network Spec Command sets a number of parameters within the modem to meet a specification. The purpose is to eliminate keystrokes and potential compatibility problems.

Data rates not covered by a given network specification will not be allowed. If the mode of operation is selected after the data rate has been entered, then the data rate must be compatible with the desired mode of operation or the network spec will not be allowed. The following parameters cannot be changed while the unit is in the given mode of operation:

IDR:

(IESS-308)

For Data rates 1.544, 2.048, 6.312, 8.448 Mbps
Framing Type: 96 Kbps (IDR)
Scrambler Type: V.35
Spectrum Mask: Intelsat

For Data Rates < 1.544
Framing Type: 1/15 (IBS)
Scrambler Type: IESS-309
Spectrum Mask: Intelsat

IBS:

(IESS-309)

For Data Rates $\leq$ 2048
Framing Type: 1/15 (IBS)
Scrambler Type: IESS-309
Spectrum Mask: Intelsat

Drop & Insert:

Data Rates: n x 64 n = 1, 2, 3, 4, 5, 6, 8, 10,12, 15, 16, 20, 24, 30
Framing Type: 1/15 (IBS)
Scrambler Type: IESS-309
Spectrum Mask: Intelsat

Efficient D&I Closed Network,
Data Rates: n x 64, N = 1-31 Any combination
Descrambler Type: IESS-309
Spectrum Mask: Intelsat

DVB: Per EN301-421 & En301-210

Data Rates:	All Rates	
Framing Type:	DVB	
	Scrambler Type:	DVB
	Spectrum Mask:	DVB 0.25, 0.35

Closed Net:

All possible combinations allowed, however, DVB settings requires the DVB network spec. Activates the AUPC Menu.

STRAP CODE **{Refer to Strap Code Guide, Appendix D}**
The Strap Code is a quick set key that sets many modem parameters. Consult the strap code guide for available strap codes. Parameters set by strap code:

Data Rate
- Inner Code Rate
- Satellite Framing
- Scrambler
- Drop and Insert
- Outer Code Rate (Reed-Solomon)
- Modulation
- Network Spec

IF (menu)

FREQUENCY (MHz) **{50 – 90 MHz, 100 – 180 MHz, or 950 - 2050 MHz}**

Allows the user to enter the Modulator IF Output Frequency of the modem in 1 Hz increments.

POWER (dBm) **{0 to -25 dBm}**
Allows the user to enter the Transmitter Power Level.

CARRIER **{ON, OFF, AUTO, VSAT, RTS}**
Allows the user to select the carrier type. Refer to Appendix E for further information.

SPECTRUM **{NORMAL, INVERTED}**
Allows the user to invert the direction of rotation for PSK Modulation. Normal meets the IESS Specification..

MODULATION **{QPSK, BPSK, OQPSK, 8PSK, 16QAM}**
Allows the user to select the modulation type.

SPECTRAL MASK **{Intelsat 0.35, DVB SAT 0.35, DVB SAT 0.25, DVB SAT 0.20}**
Allows the user to set the spectral shape of Tx Data Filter.

COMPENSATION **{0.0 – 1.0}**

Allows you to offset output power by up to 1 dbm. This is intended as a correction for user cabinet connectors.

DATA (menu)

DATA RATE (bps) **{Refer to Technical Specs for Data Rates}**
Allows the user to set the Data Rate in bps steps via the Front Panel Arrows or Keypad.

SYMB RATE (sps) Allows the user to view the Symbol Rate.

INNER FEC

Viterbi	**{1/2, 3/4, 7/8, None}**
Optional FEC Rates:	
Sequential	**{1/2, 3/4, 7/8}**
Trellis	**{8PSK}**
Turbo ≤ 20Mbps	**{.793, .495, 3/4, 7/8}**
Turbo >20Mbps	**{.750, .875}**
CSC	**{3/4}**
DVB VIT	**{2/3, 5/6}**
DVB Trellis	**{3/4, 5/6, 7/8, 8/9}**
LDPC (B/O/QPSK)	**{1/2, 2/3, 3/4}**
LDPC (8PSK)	**{2/3, 3/4}**
LDPC (8QAM)	**{2/3, 3/4}**
LDPC (QPSK/OQPSK)	**{1/2, 2/3, 3/4}**
LDPC (16QAM)	**{3/4}**

Allows the user to select the Rx Code Rate and Type

TPC INTERLEAVER **{DISABLE, ENABLE}**
Allows user to disable or enable the TPC Interleaver. Valid only for Radyne turbo codes TPC.495 and TPC.793

DIFF CODING **{ENABLED, DISABLE}**
Allows the user to enable or disable the Differential Encoder. Having the encoder enabled ensures proper phase lock. May not be adjustable in some modes.

SCRAMBLER SEL **{NONE, V.35-IESS, V.35 CITT, V.35 EF, IBS w/Optional Framing and optional Reed-Solomon, Reed-Solomon Scrambler w/Optional Framing, CCITT, V.35FC, OM-73, V.35EF_RS, TPC SCRAMBLER (Turbo Codec), DVB, EDMAC}**
Allows the user to select the descrambler type.

SCRAMBLER CTRL **{ENABLED, DISABLE}**
Allows the user to enable or disable scrambler operation.

SAT FRAMING **{1/15 (IBS), 1/15 (Async), 96 Kbps (IDR), DVB, EDMAC, EFAUPC, SCC, EFFICIENT D&I, None}**
Used with IDR, IBS, or Asynchronous Interface Only.
Allows the user to select the framing type.

IN-BAND RATE **{150, 300, 600, 1200, 2400, 4800, 9600, 19200}**
Allows the user to select the rate of in-band data for the ES to ES, Async overhead channel.
Only displayed when Effiecient D&I with Enhanced Async are selected.

SCC CTL RATIO **{1/1, 1/2, 1/3, 1/4, 1/5, 1/6, 1/7},**
Allows the user to simulate the framing used by the Satellite Control Channel Option (Pass Thru Mode only). The SCC CTL RATIO is the ratio of overhead in-band data to synchronizing words.
Only displayed when SCC Framing is selected

SCC INBAND RATE **{300 to 200000}, when using SCC Framing**
Allows the user to request the rate of in-band data for the overhead channel.
Only displayed when SCC Framing is selected

TERR FRAMING **{NONE, 188, 204}, when using DVB Network Specifications**

DATA POLARITY **{INV. TERR & BASE, INV. BASEBAND, INV.TERR DATA, NONE}**
Allows the user to invert the Tx Data polarity.

SYMBOL PAIR **{NONE, SWAPPED}**
Allows the user to swap the I & Q Channels, when using BPSK modulation.

ESC OVERHEAD **{VOICE X2, DATA 64KBPS}**
IDR ESC Channel used for Voice or 64 K data channel. Only available when IDR Network is selected.

AUPC (menu)

LOCAL AUPC (menu) The 'LOCAL AUPC CONFIGURATION' Menu contains the local configuration parameters for the AUPC Function.

AUPC MODE **{DISABLED, NEARSIDE, RADYNE, EFDATA}**

DISABLED: Allows the user to enable or disable the Local AUPC Function of the local modem.

EFDATA: Enables EFDATA Local AUPC Function. In the event that the remote or local demodulator losses lock, the output power level will adjust itself to the level settings indicated in the 'REMOTE CL ACTION' Menu or the 'LOCAL CL ACTION'.

RADYNE: Enables Radyne Local AUPC Function. In the event the remote demodulator losses lock, the local output power level will adjust itself to the nominal level. This nominal power should be set to a level high enough to re-establish communications regardless of rain fade.

NEARSIDE: Enables NEARSIDE Local AUPC function. In the event the local demodulator losses lock due to signal loss, the output power level will adjust itself to the nominal level. This nominal power should be set to a level high enough to re-establish communications regardless of rain fade.

NOMINAL TX POWER **{0 TO -25 dB}**
This allows the user to set the nominal Transmit Power. The nominal transmit power is the default output power level.

MINIMUM TX POWER **{0 to -25 dB}**
This allows the user to set the minimum Transmit Power.

EFDATA AUPC: When configured for EFDATA AUPC the minimum Transmit Power is the lowest power setting that will be used when the local modem commands a decrease of the Transmit Power from the Remote modem.

RADYNE: When configured for Radyne AUPC, the minimum Transmit Power is the lowest power setting that will be used when the remote modem commands a decrease of the Transmit Power from the Local modem.

NEARSIDE: When configured for NEARSIDE AUPC the minimum Transmit Power is the lowest power setting that will be used by the local modem when the Eb/No increases above the Eb/No target.

MAXIMUM TX POWER **{0 to -25 dB}**
This allows the user to set the maximum Transmit Power.

EF AUPC: When configured for EF AUPC, the maximum Transmit Power is the highest power setting that the local modem will use when the local modem commands an increase in Transmit power from the Remote modem.
RADYNE: When configured for Radyne AUPC, the maximum Transmit Power is the highest power setting that will be used when the remote modem commands an increase of the Transmit Power from the Local modem

NEARSIDE: When configured for NEARSIDE AUPC the maximum Transmit Power is the highest power setting that will be used by the local modem when the Eb/No decreases below the Eb/No target.

TARGET Eb/No **{4.0 to 16 dB}**

This allows the user to set the desired E_b/N_o for the local receiver.

RADYNE AUPC: When configured for Radyne AUPC, this setting is compared against the remote E_b/N_o and commands to the local modem to increase or decrease the local transmit power.

EF AUPC: When configured for EF AUPC, this setting is compared against the local received E_b/N_o and commands to the remote modem to increase or decrease transmit power.
NEARSIDE: When configured for NEARSIDE AUPC, this setting is compared against the received E_b/N_o of the local modem and commands to the local modem to increase or decrease transmit power.

TRACKING RATE **{0.5 to 6.0}**
Allows the user to set the rate at which the commands to increase or decrease Transmit Power are sent. Each command will result in a 0.5 dB increase or decrease in Transmit Power from the remote transmitter. The tracking rate is adjustable from 0.5 dB per minute to 6.0 dB per minute in 0.5 dB steps. **(Only available when EFAUPC is selected as the framing)**

LOCAL CL ACTION **{HOLD, NOMINAL, MAXIMUM}**
This allows the user to set the Remote Transmit Power Setting to be used when the local modem receiver loses lock. The setting can be 'HOLD' (no action taken), 'NOMINAL' (the nominal Transmit Power Setting is used), and 'MAXIMUM' (the maximum Transmit Power Setting is used). **(Only available when EFAUPC is selected as the framing)**

REMOTE CL ACTION **{HOLD, NOMINAL, MAXIMUM}**
This allows the user to set the Local Transmit Power Setting to be used when the remote modem receiver loses lock. The setting can be 'HOLD' (no action taken), 'NOMINAL' (the nominal Transmit Power Setting is used), and 'MAXIMUM' (the maximum Transmit Power Setting is used).

REMOTE AUPC (menu) The 'REMOTE AUPC CONFIGURATION' Menu contains the remote configuration parameters for the AUPC Function. Remote AUPC menus are only available when modem is configured for EF AUPC

AUPC MODE **{DISABLE, EFDATA}**
Allows the user to enable or disable the AUPC Function of the remote modem. The remote AUPC Function is the response of the local modem to commands for an increase or decrease of the Transmit Power in 0.5 dB steps and the command to change to the setting indicated in the 'REMOTE CL ACTION' Menu of the remote modem upon receiver loss of lock.

LOOPBACK **{DISABLE, ENABLE}**

Allows the user to enable or disable the Baseband Loopback Test Mode of the remote modem.

TX 2047 TEST **{DISABLE, ENABLE}**
Allows the user to enable or disable the Transmit 2047 Pattern Test Mode of the remote modem.

RX 2047 BER: Reports the BER measurement of the receiver 2047 Pattern Test Mode of the remote modem. BER is reported from the $1x10^{-5}$ to $1x10^{-7}$ in tenth decade steps.
if the pattern does not synchronize or is out of range, 'NO DATA' will be displayed.

When modems are configured for Radyne AUPC, the remote Eb/No will be displayed in the Monitor Menus.

REED-SOLOMON (menu) These selections are visible only when the Reed-Solomon Option is installed.

ENABLE/DISABLE **{ENABLED, DISABLE}**
Allows the user to Enable/Disable the Reed-Solomon Encoder.

RS RATE **{Refer to** Table 3-1 **for standard n/k values}**
Displays the currently used n, k Reed-Solomon Codes. In Closed Net Mode and using the appropriate hardware, the user may select custom R-S Codes.

INTERLVR DEPTH **{4, 8, 12}**
Allows the user to select the Reed-Solomon interleaver depth. In Closed Net Mode, a depth of 4 or 8 may be selected.

4.4.3 Demodulator Menu Options and Parameters

NETWORK SPEC **{IDR, IBS, DROP & INSERT, CLOSED NET, DVB SAT}**
The Network Spec Command sets a number of parameters within the modem to meet a specification. The purpose is to eliminate keystrokes and potential compatibility problems.

Data rates not covered by a given mode will not be allowed. If the mode of operation is selected after the data rate has been entered, then the data rate must be compatible with the desired mode of operation or the Network Spec will not be allowed. The following parameters cannot be changed while the unit is in the given mode of operation:

IDR:

(IESS-308)
For Data rates 1.544, 2.048, 6.312, 8.448 Mbps
Framing Type: 96 Kbps (IDR)
Descrambler type: V.35
Spectrum Mask: Intelsat

For Data Rates < 1.544 Mbps
Framing Type: 1/15 (IBS)
Descrambler Type: IESS-309
Spectrum Mask: Intelsat

IBS:

(IESS-309)
For Data Rates ≤ 2.048 Mbps
Framing Type: 1/15 (IBS)
Descrambler Type: IESS-309
Spectrum Mask: Intelsat

Drop & Insert:
Data Rates: n x 64, n = 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, 30
Framing Type: 1/15 (IBS)
Descrambler Type: IESS-309
Spectrum Mask: Intelsat

Efficient D&I Closed Network,
Data Rates: n x 64, 1-31 Any combination
Descrambler Type: IESS-309
Spectrum Mask: Intelsat

DVB: Per EN301-421 & En301-210
Data Rates: All Rates
Framing Type: DVB
Scrambler Type: DVB
Spectrum Mask: DVB 0.25, 0.35

Closed Net:
All possible combinations allowed, however, DVB settings requires the DVB network spec.

STRAP CODE **{Refer to Strap Code Guide, Appendix D}**

The Strap Code is a quick set key that sets many modem parameters. Consult the strap code guide for available strap codes. Parameters set by strap code:

Data Rate
- Inner Code Rate
- Satellite Framing
- Scrambler
- Drop and Insert
- Outer Code Rate (Reed-Solomon)
- Modulation

Network Spec

IF (menu)

FREQUENCY (MHz) **{50 – 90 MHz, 100 – 180 MHz, or 950 - 2050 MHz}**
Allows the user to enter the Modulator IF Frequency in 1 Hz increments.

SPECTRUM **{NORMAL INVERTED}**
Allows the user to invert the direction of rotation for PSK Modulation. Normal meets the IESS Specification.

MODULATION **{QPSK, BPSK, OQPSK, 8PSK, 16QAM}**
Allows the user to select the demodulation type.

SPECTRAL MASK **{Intelsat 0.35, DVB 0.35, DVB 0.25, DVB 0.20}**
Allows the user to set the spectral shape of Tx Data Filter.

SWEEP RANGE (kHz) **{±0 to 255 kHz}**
Allows the user to set the acquisition range for the demodulator

SWEEP DELAY (Sec) **{0.0 – 6553.5 sec}**
Allows the user to set the reacquisition delay time in $1/10^{th}$ second increments.

REACQ RANGE (Hz) **{0 – 65535 Hz}**
Allows the user to set the reacquisition sweep in 1 Hz increments.

ADJ CARRIER PWR **{Normal, Supressed}**
Allows the user to indicate adjacent carrier as Normal or Supressed (High Power). Unit will increase or decrease post decimation gain appropriately.

FAST ACQUISITION **{DISABLED, ENABLED}**
Allows the user to disable or enable the Rx fast acquisition capability.

Limitations of Fast Acquistion:
The maximum symbol rate for Fast Acquistion is 1028Ksps.
Fast Acquistion must be disable for rates greater than 1028Ksps.
Only supports QPSK and 8PSK in a NON-DVB MODE.
Does not support spectral inversion applications.

INPUT THRESHOLD (dBm) **{-30 to 90 dbm}**
Allows the user to adjust the low level threshold limit for input power. Input power level below the threshold limit will trigger a major alarm on the demodulator.

EB/NO ALARM **{0.0 to 9.90 db}**
Allows the user to set the desired E_b/N_o for the local receiver. This setting is compared against the receive E_b/N_o and commands to the remote modem to increase or decrease Transmit Power accordingly are sent.

DATA (menu)

DATA RATE (bps) **{Refer to Technical Specs for Data Rates}**

Allows the user to set the Data Rate in bps steps via the Front Panel Arrows or Keypad.

SYMB RATE (sps) Allows the user to view the Symbol Rate.

INNER FEC

Viterbi	**{1/2, 3/4, 7/8, None}**
Optional FEC Rates:	
Sequential	**{1/2, 3/4, 7/8}**
Trellis	**{8PSK}**
Turbo ≤ 20Mbps	**{.793, .495, 3/4, 7/8}**
Turbo >20Mbps	**{.750, .875}**
CSC	**{3/4}**
DVB VIT	**{2/3, 5/6}**
DVB Trellis	**{3/4, 5/6, 7/8, 8/9}**
LDPC (B/O/QPSK)	**{1/2, 2/3, 3/4}**
LDPC (8PSK)	**{2/3, 3/4}**
LDPC (8QAM)	**{2/3, 3/4}**
LDPC (QPSK/OQPSK)	**{1/2, 2/3, 3/4}**
LDPC (16QAM)	**{3/4}**

Allows the user to select the Rx Code Rate and Type

TPC INTERLEAVER **{DISABLED, ENABLED}**

Allows the user to disable or enable TPC Interleaver. Valid only for Radyne turbo codes TPC.495 and TPC.793.

DIFF CODING **{ENABLED, DISABLE}**
Allows the user to enable or disable the Differential Decoder. Having the decoder enabled ensures proper phase lock. May not be adjustable in some modes.

SCRAMBLER SEL **{NONE, V.35-IESS, V.35 CITT, V.35 EF, IBS w/Optional Framing and optional Reed-Solomon, Reed-Solomon Scrambler w/Optional Framing, CCITT, V.35FC, OM-73, V.35EF_RS, TPC SCRAMBLER (Turbo Codec), DVB, EDMAC}**
Allows the user to select the descrambler type.

SCRAMBLER CTRL **{ON, OFF}**
Allows the user to enable or disable the descrambler operation.

SAT FRAMING **{1/15 (IBS), 1/15 (Async), 96 Kbps (IDR), EDMAC, EFAUPC, SCC, EFFICIENT D&I, None}**
Used with IDR, IBS, or Asynchronous Interface Only.
Allows the user to select the Framing Type.

IN-BAND RATE **{150, 300, 600, 1200, 2400, 4800, 9600, 19200}**
Allows the user to select the rate of in-band data for the ES to ES, Async overhead channel. **Only displayed when Effiecient D&I with Esc Enhanced are selected.**

SCC CTL RATIO **{1/1, 1/2, 1/3, 1/4, 1/5, 1/6, 1/7}**
Allows the user to simulate the framing used by the Satellite Control Channel Option (Pass Thru Mode only). The SCC CTL RATIO is the ratio of overhead in-band data to synchronizing words.
Only displayed when SCC Framing is selected.

SCC INBAND RATE **{300 to 200000},**
Allows the user to request the rate of in-band data for the overhead channel.
Only displayed when SCC Framing is selected.

TERR FRAMING **{NONE, 188, 204}, when using DVB Network Spec**

DATA POLARITY **{INV. TERR & BASE, INV. BASEBAND, INV.TERR DATA, NONE}**
Allows the user to invert the Rx Data polarity.

SYMBOL PAIR **{NONE, SWAPPED}**
Allows the user to swap the I & Q Channels, when using BPSK Modulation.

ESC OVERHEAD **{VOICE X2, DATA 64KBPS}**
IDR ESC Channel used for Voice or 64 K data channel.
Only available when IDR Network is selected.

REED-SOLOMON (menu) These selections are visible only when the Reed-Solomon Option is installed.

ENABLE/DISABLE **{ENABLED, DISABLED}**
Allows the user to Enable/Disable the Reed-Solomon Encoder.

RS RATE **{Refer to** Table 3-1 **for standard n/k values}**
Displays the currently used n, k Reed-Solomon Codes. In Closed Net Mode and using the appropriate hardware, the user may select custom R-S Codes.

INTERLVR DEPTH **{4, 8, 12}**
Allows the user to select the Reed-Solomon interleaver depth.

CNC (menu) These selections are visible only when the Carrier in Carrier card is installed.

ENABLE/DISABLE **{ENABLED, DISABLED}**
Allows the user to Enable/Disable the Carrier in Carrier.

MIN SRCH DELAY **{Minimum Search Delay (ms), 0 to Max}**

MAX SRCH DELAY **{Maximum Search Delay (ms), Min to 330ms}**

FREQ OFFST RNG **{Range of Frequency Offset (KHz) between the Interferer and the desired received signal. (+/- 1Khz to +/- 32Khz)}**

4.4.4 Interface Menu Options and Parameters

TX SETUP (menu)

CIRCUIT ID Allows the user entry of a Tx Circuit Identifier. Circuits can be given up to an 11 Character alphanumeric identity such as LINK1.

TERR INTERFACE **STANDARD INTERFACE**
{RS422 SERIAL,RS232 SERIAL, V.35}

OPTIONAL HARDWARE INTERFACES
{M2P PARALLEL, DVB PARALLEL, ASI}
{HSSI}
{ETHERNET 10/100 BASE-T}
{G.703: T1 AMI, T1 B8ZS, , E1 BAL, E1 UNBAL, T2 BAL, T2 UNBAL, E2}
{G.703: T1 AMI, T1 B8ZS, , E1 BAL, E1 UNBAL, T2 BAL, T2 UNBAL, E2, E3, T3, STS1}

Allows the user to select the Transmit Interface Type.

ETH FLOW CONTROL **{Disabled, Enabled}**
Allows the user to disable or enable flow control. *Only visible when Ethernet is selected as the interface type.*

ETH DAISY CHAIN **{Disabled, Enabled}**
Allows the user to disable the Ethernet Port Daisy Chaining. *Only visible when Ethernet is selected as the interface type.*

ETH QOS TYPE **{NORMAL, PORT BASED}**
Selects the priority hierarchy of processing an IEEE 803.3ac Tag, Ipv4 Type of Service Field / Differentiated Services Field, or Ipv6 Traffic Class Field. The Port Based priority overrides any standard priority. When operating in this mode, (JS1) has the highest priority and
(JS4) has the lowest.

ETH QOS QUEUE **{FAIR WEIGHTED, STRICT PRIORITY}**
Selects the queue weighting of 8,4,2,1 that insures even the lowest priority traffic gets some bandwidth. Strict Priority insures that the higher priority traffic will always be transmitted before any lower priority traffic. With this setting, the lower priority traffic can starve.

TX CLK SRC **{SCTE, SCT, EXT CLK}**
Allows the user to select the Transmit Clock Source.

TX CLK POL **{AUTO, NORMAL, INVERTED}**
Allows the user to select the Clock Polarity for the Tx Terrestrial Clock relative to the Tx Data. "Auto" detects wrong polarity and automatically corrects. If G.703 Interface is selected, this selection cannot be changed.

SCT CLK SRC **{SCT, SCR}**
Allows the user to select SCT Source.SCT is the internally generated SCT clock. SCR is the Rx Satellite clock. SCR us used for loop timing.

DROP & INSERT (menu) (Reference Section 3.13, "Drop and Insert Mapping" in this manual)

DROP MODE **{NONE, T1-D4, T1-ESF, PCM-30, PCM-30C, PCM-31, PCM-31C, T1-D4-S, T1-ESF-S.}**
Drop mode may only be changed from none when the drop and insert specification is in use.

MAP COPY **{SRC Map Dest Map}**

Allows the user to copy drop and insert maps. Tx Act map is the drop map currently being used by the modem. Source and destination may be any of the following:

TX ACT, RX ACT, TX EDIT, RX EDIT,
USER 1 - USER 8, ROM 1 -ROM 8

SAT CH TERRCH **{1-31 1-31}**

The up/down arrow keys allow you to traverse the sat terr pairings. The slot numbers may be edited using the keypad.

Allows the user to edit the Tx Edit map and specify the terrestrial slots that will be dropped into the assigned satellite channels. The satellite channels are fixed and the number of channels are determined by the data rate. The terrestrial time slots available are determined by the drop mode. When the user has finished editing the Tx Edit map, it must be copied to the Tx Act map before it will be used by the modem.

ESC CHAN#1 (dB) **{-20 to +10 dB}**
Allows user to select ESC Voice Channel Gain. Only displayed when IDR NETWORK and VOICE Channel are selected.

ESC CHAN#2 (dB) **{-20 to +10 dB}**
Allows user to select ESC Voice Channel Gain. Only displayed when IDR NETWORK and VOICE Channel are selected.

RX SETUP (menu)

CIRCUIT ID Provides entry of Rx Circuit Identifier. Circuits can be given up to an 11 Character alphanumeric Identity such as DLINK1

TERR INTERFACE **STANDARD INTERFACE**
{RS422 SERIAL,RS232 SERIAL, V.35}

OPTIONAL HARDWARE INTERFACES:
{M2P PARALLEL, DVB PARALLEL, ASI}
{HSSI}
{ETHERNET 10/100 BASE-T}
{G.703: T1 AMI, T1 B8ZS, , E1 BAL, E1 UNBAL, T2 BAL, T2 UNBAL, E2}
{G.703: T1 AMI, T1 B8ZS, , E1 BAL, E1 UNBAL, T2 BAL, T2 UNBAL, E2, E3, T3, STS1}

Allows the user to select the Transmit Interface

BUFF SIZE (msec) **{0 - 64 msecs}**

Allows the user to set the Doppler Buffer Size in msec.

BUFFER CLK SRC

The user must assign priorities to the clock sources. 1 being the highest priority and 5 being the last resort. The menu has three fields; the first field is the name of the clock source, the second field is the priority entry area, and the last field is the depth of the list. In the priority field, the up/down arrow keys will scroll through the list displaying the names and the current priority. When the desired clock name is displayed, the number keys may be used to assign a priority value. Pressing <Enter> will re-sort the list. Do this until the clock sources are prioritized in the order desired. Use the left/right arrow keys to move the cursor to the depth field. This field assigns the number of entries to use. The number keypad or the up/down arrows can be used to change the value.

Clock Source	Priority		SRC DEPTH	
RX SAT	1	of	3	} Only these will be used
SCTE	2	of	3	
SCT	3	of	3	
EXT BNG	4	of	3	} Will not be used since 4>3 and 5>3
EXT IDI	5	of	3	

MAP COPY {SRC Map Dest Map}

Allows the user to copy drop and insert maps. Tx Act map is the drop map currently being used by the modem. Source and destination may be any of the following:

TX ACT, RX ACT, TX EDIT, RX EDIT,
USER 1 - USER 8, ROM 1 -ROM 8

SAT CH TERRCH {1-31 1-31}

The up/down arrow keys allow you to traverse the sat terr pairings. The slot numbers may be edited using the keypad.

Allows the user to edit the Tx Edit map and specify the terrestrial slots that will be dropped into the assigned satellite channels. The satellite channels are fixed and the number of channels are determined by the data rate.

The terrestrial time slots available are determined by the drop mode. When the user has finished editing the Tx Edit map, it must be copied to the Tx Act map before it will be used by the modem.

BUFFER CLOCK POL {NORMAL, INVERTED}

Allows the user to select the Buffer Clock Polarity for the Tx Terrestrial Clock relative to the Tx Data. If G.703 Interface is selected, this selection cannot be changed.

DROP & INSERT (menu)

INSERT MODE **{NONE, T1-D4, T1-ESF, PCM-30, PCM-30C, PCM-31, PCM-31C, T1-D4-S, T1-ESF-S.}**
Allows the user to select any of the above.

T1/E1 FRAME SRC **{INTERNAL, EXTERNAL}**
Selects the frame source for T1 or E1 framing.

TERR STREAMING **{BYTE OUTPUT, PACKET OUTPUT} ASI only**
Byte output = continuous
Packet output = burst

ESC CHAN#1 (dB) **{-20 to +10 dB}**
Allows user to select ESC Voice Channel Gain. Only displayed when IDR NETWORK and VOICE Channel are selected.

ESC CHAN#2 (dB) **{-20 to +10 dB}**
Allows user to select ESC Voice Channel Gain. Only displayed when IDR NETWORK and VOICE Channel are selected.

GENERAL (menu)

EXT FREQ (MHz) **{Variable Through Data Rate}**
Allows the user to select the external clock frequency in MHz.

REF FREQ SRC **{INTERNAL, EXTERNAL, HIGH STABILITY}**
Allows the user to select the Frequency Reference Source. High Stability is only displayed if the appropriate hardware is detected.

REF FREQ (MHz) Allows the user to select the reference clock frequency in MHz.

TX ASYNC MODE (menu)

TX ASYNC MODE **{ES-ES, ESC ENHANCED}**
ES-ES is the normal IBS Async Channel. ESC Enhanced can be selected in Closed Net and uses the Overhead Signaling bytes in the IBS Overhead to pass asynchronous data.

ES INTERFACE **{RS-232, RS-485}**
Allows the user to select the interface type.

ES BAUD RATE **{150 - 19200}**
Allows the user to select the baud rate in Enhanced Async Mode. Available rates are listed in Table 3-3.

ES BITS/CHAR **{7,8}**
Allows the user to choose between 7 or 8 bit data.

RX ES ENHANCED (menu)

RX ASYNC MODE **{ES-ES, ESC ENHANCED}**
ES-ES is the normal IBS Async Channel. ESC Enhanced can be selected in Closed Net and uses the Overhead Signaling bytes in the IBS Overhead to pass asynchronous data.

ES INTERFACE **{RS-232, RS-485}**
Allows the user to select the interface type.

ES BAUDRATE **{150 – 19200}**
Allows the user to select the Baud rate in Enhanced Async Mode.

ES BITS/CHAR **{7,8}**
Allows the user to choose between 7 or 8 bit data.

4.4.5 Monitor Menu Options and Parameters

EVENTS Displays a history of events recorded in the event buffer. A maximum of 100 events may be stored in the buffer. Upon receipt of the 101st event, the first received event is automatically deleted, and so on, maintaining the maximum 100 events.

ERASE EVENTS.. PRESS CLEAR Allows the user to clear the contents of the Event Buffer by pressing <CLEAR> on the keypad.

INPUT LVL (dBm) Displays the estimated receive signal level as seen by the Demodulator.

EBNO (dB) Displays the estimated E_b/N_o as seen by the demodulator.

REMOTE EB/NO Remote EB/NO displayed when modem is configured for Radyne AUPC.

RAW BER Displays the estimated channel error rate (before decoding) measured by the modem.

CORRECTED BER The CBER display shows an estimated corrected bit error rate of the modem. Depending on the symbol rate the modem is running, the high-end performance scale of this display will vary (10 E^{-9}, 10^{-10} or 10^{-11}). At some symbol rates, a better than scale

reading will appear as 0.0 x 10^{-00}. At other symbol rates, it will appear as E**. In either case, they both mean performance is better than the scale upper limit.

BIT ERRORS Displays the current error count from the Viterbi Decoder.

FREQ OFFSET Displays the received carrier frequency offset as measured by the modem.

TOTAL PACKETS Displays the total number of Ethernet packets received from the satellite ***(Only visible when Ethernet is selected as the interface type).***

ERROR PACKETS Displays the number of error Ethernet packets received from the satellite ***(Only visible when Ethernet is selected as the interface type).***

PKT ERROR RATE Displays the satellite Packet Error Rate ***(Only visible when Ethernet is selected as the interface type)***.

PKT STATS RESET Allows the user to reset the Ethernet packet statistics by pressing <Enter> ***(Only visible when Ethernet is selected as the interface type).***

LINK STATUS (menu) ***(the following sub-menus only display when Ethernet is selected as the interface type)***

NOTE

The status of the following ports may be one of the following:

Down:	***The link is down.***
Unresolved:	***Unable to agree on connection speed.***
10 Mbps Half:	***Connected at 10 Base-T Half Duplex.***
10 Mbps Full:	***Connected at 10 Base-T Full Duplex.***
100 Mbps Half:	***Connected at 100 Base-T Half Duplex.***
100 Mbps Full:	***Connected at 100 Base-T Full Duplex.***
Unused:	***The port is not available.***

JS1 STATUS **{See the note above}**
Displays the current status of the LAN Port.

JS2 STATUS **{See the note above}**
Displays the current status of the LAN Port.

JS3 STATUS	**{See the note above}** Displays the current status of the LAN Port.
JS4 STATUS	**{See the note above}** Displays the current status of the LAN Port.
WAN STATUS	**{See the note above}** Displays the current status of the WAN Port.

VOLTAGES (menu)

+1.5V RX SUPPLY	Displays the measured voltage of the 1.5 Volt Rx power bus located inside the modem.
+1.5V TX SUPPLY	Displays the measured voltage of the 1.5 Volt Tx power bus located inside the modem.
+3.3V SUPPLY	Displays the measured voltage of the +3.3 Volt power bus located inside the modem.
+5V SUPPLY	Displays the measured voltage of the +5 Volt power bus located inside the modem.
+12V SUPPLY	Displays the measured voltage of the +12 Volt power bus located inside the modem.
+20V SUPPLY	Displays the measured voltage of the +20 Volt power bus located inside the modem.
-12V SUPPLY	Displays the measured voltage of the -12 Volt power bus located inside the modem.

CnC (menu)

CnC DELAY	Routine delay (ms)
CnC FREQ OFFST	Runtime Frequency Offset (KHz) between interferer and the desired received signal.
CnC RATIO	Power Ratio between interferer and the desired signal in dB.

RX BUFFER LEVEL	**{0 – 100%}** Displays the status of the Doppler Buffer.
RX BUFFER RESET ((ENTER))	Allows the user to re-center the Doppler Buffer when <ENTER> is pressed on the keypad.

4.4.6 Alarms Menu Options and Parameters

CAUTION!!

Masking alarms may cause undesirable modem performance.

CURRENT ALARMS (menu)

TX MAJOR (menu)*Status* *Edit Table*

FPGA CFG **{Pass/Fail, Unmasked/Masked}**
Indicates a transmit FPGA configuration failure.

DSP CFG **{Pass/Fail, Unmasked/Masked}**
Indicates a transmit DSP configuration failure.

SCT CLOCK PLL **{Pass/Fail, Unmasked/Masked}**
Indicates that the Tx SCT Clock PLL is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a configuration failure within the modem.

SYM CLOCK PLL **{Pass/Fail, Unmasked/Masked}**
Indicates that the Tx Symbol Clock PLL is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a problem with the incoming clock to the modem (SCTE).

LB SYNTH PLL **{Pass/Fail, Unmasked/Masked}**
Indicates that the Tx L-Band Synthesizer is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a configuration problem within the modem.

IF SYNTH PLL **{Pass/Fail, Unmasked/Masked}**
Indicates that the Tx IF Synthesizer is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a configuration problem within the modem.

ETHERNET WAN **{Pass/Fail, Unmasked/Masked}**
Indicates that the interface card is faulted and will not pass data ***(displays only when the Ethernet Card is installed and the Ethernet Interface is selected).***

FORCED ALARM **{DISABLED, ENABLED}**
Allows user to disable or enable forcing of a Tx Summary Alarm.

TX MINOR (menu)

TERR CLK ACT **{Pass/Fail, Unmasked/Masked}**
Indicates no Terrestrial Clock activity.

TERR DATA ACT **{Pass/Fail, Unmasked/Masked}**
Indicates no Tx Data activity.

TX TERR AIS **{Pass/Fail, Unmasked/Masked}**
Indicates that AIS has been detected in the Tx Data Stream.

DnI FRAME LOCK **{Pass/Fail, Unmasked/Masked}**
Indicates the framing unit is unable to find the expected terrestrial framing pattern.

DnI M-FRAME LOCK **{Pass/Fail, Unmasked/Masked}**
Indicates the framing unit is unable to find the expected inter-frame pattern.

TX DVB FRM LOCK **{Pass/Fail, Unmasked/Masked}**
Indicates that Tx input data stream framing does not match the user selected TX TERR FRAMING.

RX MAJOR (menu)

FPGA CFG **{Pass/Fail, Unmasked/Masked}**
Indicates a receive FPGA hardware failure.

DSP CFG **{Pass/Fail, Unmasked/Masked}**
Indicates a receive DSP failure.

SIGNAL LOCK **{Pass/Fail, Unmasked/Masked}**
Indicates that the demod is unable to lock to a signal.

INPUT LVL THRESH **{Pass/Fail, Unmasked/Masked}**
Indicates Rx signal level has fallen below input threshold.

FRAME LOCK **{Pass/Fail, Unmasked/Masked}**
Indicates that the Framing Unit is unable to find the expected framing pattern.

MULTIFRAME LOCK **{Pass/Fail, Unmasked/Masked}**
This alarm will flash on during certain modem parameter changes. A solid indication points toward a problem with the incoming clock to the modem (SCTE).

LB SYNTH PLL **{Pass/Fail, Unmasked/Masked}**
Indicates that the Rx L-Band Synthesizer is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a configuration problem within the modem.

IF SYNTH PLL **{Pass/Fail, Unmasked/Masked}**
Indicates that the Rx IF Synthesizer is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a configuration problem within the modem.

ETHERNET WAN Indicates that the interface card is faulted and will not pass data ***(displays only when the Ethernet Card is installed and the Ethernet Interface is selected).***

FORCED ALARM **{DISABLED, ENABLED}**
Allows user to enable a forced Rx summary alarm.

RX MINOR (menu)

BUFF UNDERFLOW **{Pass/Fail, Unmasked/Masked}**
Indicates that a Doppler Buffer underflow has occurred.

BUFF NEAR EMPTY **{Pass/Fail, Unmasked/Masked}**
Indicates that the Doppler Buffer is about to underflow.

BUFF NEAR FULL **{Pass/Fail, Unmasked/Masked}**
Indicates that the Doppler Buffer is about to overflow.

BUFF OVERFLOW **{Pass/Fail, Unmasked/Masked}**
Indicates that a Doppler Buffer overflow has occurred.

RX DATA ACTIVITY **{Pass/Fail, Unmasked/Masked}**
Indicates that there is no Rx Data activity.

SAT AIS **{Pass/Fail, Unmasked/Masked}**
Indicates that AIS has been detected in the receive satellite data stream.

DnI FRAME LOCK **{Pass/Fail, Unmasked/Masked}**
Indicates if drop/insert data is frame locked.

DnI M-FRAME LOCK **{Pass/Fail, Unmasked/Masked}**
Indicates if drop/insert data has multiframe lock.

INSERT CRC **{Pass/Fail, Unmasked/Masked}**
Indicates if the Circular Redundancy Check is passing in PCM-30C and PCM-31C Modes.

T1/E1 SIGNALING **{Pass/Fail, Unmasked/Masked}**
The interface is not deleting the expected signaling information.

IFEC LOCK **{Pass/Fail, Unmasked/Masked}**
Indicates that the Framing Unit is unable to find the expected framing pattern.

OFEC LOCK **{Pass/Fail, Unmasked/Masked}**
Indicates that the Reed-Solomon Decoder is not locked.

INTERLEAVER **{Pass/Fail, Unmasked/Masked}**
Indicates that the Reed Solomon Interleaver is not synchronized.

RS UNCORR WORD **{Pass/Fail, Unmasked/Masked}**
Indicates status of the Reed Solomon uncoded word fault.

TPC IFEC LOCK **{Pass/Fail, Unmasked/Masked}**

EBNO (dB) **{Pass/Fail, Unmasked/Masked}**
Indicates that the Eb/No is outside of limits.

RX AGC LEVEL **{Pass/Fail, Unmasked/Masked}**
Indicates if Rx level is below allowable limits.

IBS BER **{Pass/Fail, Unmasked/Masked}**
Indicates that there are more than one in 1000 bits in error in IBS Mode.

RX DVB FRM LOCK **{Pass/Fail, Unmasked/Masked}**
Indicates that the Rx Satellite Data Stream Framing is not DVB.

COMMON (menu)

TERR FPGA CFG **{Pass/Fail, Unmasked/Masked}**
Indicates an Interface Card FPGA configuration failure.

CODEC FPGA CFG **{Pass/Fail, Unmasked/Masked}**
Indicates Turbo Codec Card FPGA configuration failure.

CODEC DEV CFG **{Pass/Fail, Unmasked/Masked}**
Indicates Turbo Codec Card ASIC configuration failure.

VOLTAGES (menu)

+1.5V RX SUPPLY **{Pass/Fail, Unmasked/Masked}**

Displays the measured voltage of the 1.5 Volt Rx power bus located inside the modem.

+1.5V TX SUPPLY **{Pass/Fail, Unmasked/Masked}**

Displays the measured voltage of the 1.5 Volt Tx power bus located inside the modem.

+3.3V SUPPLY **{Pass/Fail, Unmasked/Masked}**

Displays the measured voltage of the +3.3 Volt power bus located inside the modem.

+5V SUPPLY **{Pass/Fail, Unmasked/Masked}**

Displays the measured voltage of the +5 Volt power bus located inside the modem.

+12V SUPPLY **{Pass/Fail, Unmasked/Masked}**

Displays the measured voltage of the +12 Volt power bus located inside the modem.

+20V SUPPLY **{Pass/Fail, Unmasked/Masked}**

Displays the measured voltage of the +20 Volt power bus located inside the modem.

-12V SUPPLY **{Pass/Fail, Unmasked/Masked}**
Displays the measured voltage of the -20 Volt power bus located inside the modem.

EXT CLOCK ACT **{Pass/Fail, Unmasked/Masked}**
Indicates the External Clock activity.

EXT REF ACT **{Pass/Fail, Unmasked/Masked}**
Indicates the External Reference activity.

EXT REF LOCK **{Pass/Fail, Unmasked/Masked}**
Indicates the External Reference PLL is locked detection.

Refer to Section 4.4.6, "CURRENT ALARMS (menu)" for an explanation of the Latched Alarms Menu Options and Parameters.

LATCHED ALARMS **{Pass/Fail}**
The following alarms are latched in order to catch intermittent failures:

TX MAJOR (menu)

FPGA CFG

DSP CFG

SCT CLOCK PLL

SYM CLOCK PLL

LB SYNTH PLL

IF SYNTH PLL

ETHERNET WAN

TX MINOR (menu)

TERR CLK ACT

TERR DATA ACT

TX TERR AIS

DnI FRAME LOCK

DnI M-FRAME LOCK

DROP CRC

TX DVB FRM LOCK

RX MAJOR (menu)

FPGA CFG

DSP CFG

SIGNAL LOCK

FRAME LOCK

MULTIFRAME LOCK

LB SYNTH PLL

IF SYNTH PLL

ETHERNET WAN

RX MINOR (menu)

BUFF UNDERFLOW

BUFF NEAR EMPTY

BUFF NEAR FULL

BUFF OVERFLOW

RX DATA ACTIVITY
SAT AIS

DnI FRAME LOCK

DnI M-FRAME LOCK

INSERT CRC

T1/E1 SIGNALING

IFEC LOCK

OFEC LOCK

INTERLEAVER

RS UNCORR. WORD

TPC IFEC LOCK

EBNO

RX LEVEL

IBS BER

RX DVB FRM LOCK

COMMON (menu)

TERR FPGA CFG

CODEC FPGA CFG

CODEC DEV CFG

VOLTAGE (menu)

+1.5V RX SUPPLY

+1.5V TX SUPPLY

+3.3V SUPPLY

+5V SUPPLY

+12V SUPPLY

-12V SUPPLY

+20V SUPPLY

EXT CLOCK ACT

EXT REF ACT

EXT REF LOCK

CLEAR LATCHED ((ENTER)) Allows the user to reset the latched alarms by pressing <ENTER> on the keypad.

BACKWARD ALARMS The following IBS and IDR Backward alarms only apply if the IDR or IBS options are selected. The IBS and IDR Backward Alarms are transmitted and received from the distant end of the satellite link

NOTE: The following alarms identify the status of the alarms received from the distant satellite end.

IDR1 SAT ALARM 1 **{PASS, FAIL}**

IDR1 SAT ALARM 2 **{PASS, FAIL}**

IDR1 SAT ALARM 3 **{PASS, FAIL}**

IDR1 SAT ALARM 4 **{PASS, FAIL}**

IBS SAT ALARM **{PASS, FAIL}**

T1E1 SATTERR ALM **{PASS, FAIL}**

MAP SUMMARY **{NONE, BK 1; BK 2; BK 1, 2; BK 3; BK 1, 3; BK 2, 3; BK 1, 2, 3; BK 4; BK 1,4; BK 2,4; BK 1, 2,4; BK 3,4; BK 1, 3,4; BK 2, 3,4; BK 1, 2, 3,4}**

Summary alarm is given when criteria meets the selection above.

NOTE: The following alarms identify the control status of the alarms transmitted to the distant satellite end.

IDR1 SAT CNTRL **{STNDRD, FRC ON, FRC OFF}**

STNDRD: Set Alarm functions in a normal configuration

FRC ON: Forces an ON alarm status that is transmitted to the distant end.

FRC OFF: Forces an OFF alarm status that is transmitted to the distant end.

IDR2 SAT CNTRL **{STNDRD, FRC ON, FRC OFF}**

IDR3 SAT CNTRL **{STNDRD, FRC ON, FRC OFF}**

IDR4 SAT CNTRL **{STNDRD, FRC ON, FRC OFF}**

IBS SAT CNTRL **{STNDRD, FRC ON, FRC OFF}**
T1E1 TERR CNTRL **{STNDRD, FRC ON}**

IBS TX PROMPT **{STNDRD, FRC ON}**

IBS TX SERVICE **{STNDRD, FRC ON}**

4.4.7 System Menu Options and Parameters

DATE (MM/DD/YY) Allows the user to enter the current date.

TIME {HH:MM:SS} Allows the user to enter the current time.

CONFIG COPY **{Current, CFG1……CFG10}**
Allows user to copy, save and recall modem configurations.

FRONT PANEL (menu)

BKLT LEVEL **{OFF, LOW, MED, HIGH}**
Allows the user to enter the backlight intensity level.

BKLT TIMEOUT **{00 - 99}**
Allows the user to enter the length of time (in seconds) of keyboard inactivity before the backlight shuts off. 00 = no timeout.

KEY CLICK **{ON, OFF}**
Allows the user to enable or disable the audible beep each time a key is pressed. Illegal entries will still cause a beep to be heard.

MENU NAVIGATION **{STANDARD, FLOATING}**
Standard: This setting has a fixed starting point for all sub-menus.

Floating: Sub-menus are floating, always returning to the last menu that was accessed.

LED TEST **{ENTER}**
Allows user to test all front panel LEDs.

REMOTE CONTROL **{TERMINAL, COMPUTER}**
Allows the user to select between terminal RS-232 control and remote port M&C RS-232/-485 control.

TERMINAL (menu)

TYPE **{VT-100, WYSE50, VIEWPOINT}**
Allows the user to select the emulation type.

BAUD RATE **{300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600}**
Allows the user to enter the terminal baud rate.

REMOTE PORT (menu)

ADDRESS **{32 - 255}**
Allows the user to enter the Remote Port Multidrop Address.

BAUD RATE **{300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600}**
Allows the user to enter the Remote Port Baud Rate.

INTERFACE **{RS-232, RS-485}**
Allows the user to enter the Remote Port interface type.

TCP/IP (menu)

BOOT MODE **{DEFAULT, NON-VOL, BOOTP, IP TEST}**

DEFAULT: During initialization (boot up), the modem will restore the web setting to the standard IP Mask and addresses supplied by the modem. The modem will be taken off the network and will not be accessible. The Default settings are:

IP Address Mask:	255.000.000.000	(FF.00.00.00 hex)
Modem IP Address:	010.000.000.001	(C0.A8.00.EE hex)
Server IP Address:	010.001.001.001	(0A.01.01.01 hex)
Router IP Address:	010.000.001.001	(0A.00.01.01 hex)

BOOTP: During initialization (boot up), the modem will get the names, masks, and IP Addresses of the modem, router, and server.

NON-VOL: Stores and uses IP Mask and addresses as provided by the user.

IP TEST: Stores and uses IP Mask and addresses to fixed settings as listed below.

Bootp Server Tag:	206	
IP Address Mask:	255.255.255.000	(FF.FF.FF.00 hex)
Modem IP Address:	192.168.0.238	(C0.A8.00.EE)
Server IP Address:	192.168.000.101	(C0.A8.00.65)
Router IP Address:	192.168.000.102	(C0.A8.00.66)

BOOTp SERVER **{128 – 257, default is 206}**
Only used if Bootp is selected in Boot Mode. Should be consistent with the tag expected by the users Bootp Server.

MODEM HOST The Host Modem for the network.

IP ADDR MASK **{XXX.XXX.XXX.XXX} Hexidecimal Mask**
{ddd.ddd.ddd.ddd} Decimal Mask
The IP Address Mask of the local network. The mask is expressed in a hexadecimal format, and must be a valid TCP/IP Mask. This field should be set before changes are made to the Modem or Router Address.

MODEM IP ADDR **{XXX.XXX.XXX.XXX} Hexidecimal Address**
{ddd.ddd.ddd.ddd} Decimal Mask
The IP Address of the modem. This address should be consistent for the mask defined. This address is expressed in hexadecimal format. Broadcast and loop back addresses will not be allowed. These are addresses with all subnet bits set to 0's or 1's.

SERVER IP ADDR **{XXX.XXX.XXX.XXX} Hexidecimal Address**
{ddd.ddd.ddd.ddd} Decimal Address
The IP Address of the Boot Server and the address of the SNMP Trap Server when SNMP is active. If a server is used and there is no local router, this address must be consistent with the modem address. If a router has been specified, the address is presumed to be reachable via the router. Broadcast and loop back addresses will not be allowed. These are addresses with all subnet bits set to 0's or 1's.

ROUTER IP ADDR **{XXX.XXX.XXX.XXX} Hexidecimal Address**
{ddd.ddd.ddd.ddd} Decimal Address
The IP Address of the Local Network Router. If a router is present on the local network, this address must be consistent with the IP Mask and the subnet of the modem. If no router is present, then the address should be set to a foreign address. This address is expressed in hexadecimal format.

Broadcast and loop back addresses will not be allowed. These are addresses with all subnet bits set to 0's or 1's.

To change the display for the IP ADDRESS MASK, MODEM IP ADDRESS, SERVER IP ADDRESS, AND ROUTER IP ADDRESS, press all four arrow keys simultaneously.

MODEM EADDR **{001065010000}**
Displays the Ethernet address of the device. Set at the factory and is a unique identifier for the Ethernet physical interface.

ETHER RATE **{10 MBPS/HD}**
The data rate for the local Ethernet Interface.
10 Mbps/HD – for 10 Base-T in either half-duplex or full duplex.

SNMP (menu)

A description of OID organization is provided in the MIB portion of this manual (Appendix C).

SNMP VERSION **{V1 & V2, V3}**
This selection controls the SNMP Version that will be used in messaging between the equipment and it's host.

When V1 & V2 is used, RD COMMUNITY and RDWR COMMUNITY are used to determine the authorization of an incoming message.

When V3 is used, three contexts are supported: ***public***, ***mib2***, and ***dev***. Context, Authentication and Privacy are a portion of each SNMPV3 message.

The ***public*** context will only allow the user to see the sysoid of the unit. This is the most restricted access possible and only allows the unit to be identified by a host SNMP Station.

The ***mib2*** context allows a user with appropriate authentication to access the mib2 OIDs and the SNMP OIDs. These are of interest primarily to network operators not controlling the satellite link.

The ***dev*** context allows a user with appropriate authentication to access the device control portion of the MIB. These OIDs are used to control the devices satellite link and operation.

TRAP VERSION **{V1, V2}**

This controls the type of message format used when a message trap is generated by the equipment and bound for a SNMP Host. Messages will only be sent if the unit has been authorized to do so.

AUTHORIZATION **{TRAPS OFF, TRAPS ON}**
This controls the type of message format used when a message trap is generated by the equipment and bound for a SNMP host. Messages will only be sent if the unit has been authorized to do so.

RD COMMUNITY **{16 characters of name}**
This menu is only displayed when SNMP VERSION is set to V1 & V2.

This is the community that a host must be acting within when an OID variable is requested by a V1/V2 SNMP message.

RDWR COMMUNITY **{16 characters of name}**
This menu is only displayed when SNMP VERSION is set to V1 & V2.

This is the community that a host must be acting within when an OID variable is being changed by a V1/V2 SNMP message.

FTP (menu)

USER ID Allows the user to enter the user identification for access to an FTP session.

PASSWORD Allows the user to enter the password for access to an FTP session.

WEB

CONFIRMATION **{ENABLE, DISABLE}**

USER 1

ACCESS GROUP **{NO GROUP, GUEST, OPER, ADMIN}**

Access rights represent the following:

No Group: Denies Access

Guest: Users are able to navigate most of the site, and view modem parameter settings.

Oper: Users can monitor and and control parameter settings, and change their own authentication passwords.

Admin: At this highest access right, the users can monitor and control the modems parameters, change any user's name and

authentication password, and modify IP network settings. Admin setting allows access to the entire site.

AUTH PASSWORD **{xxxxxxxx}**
User to select password. The user can modify the Authorization Passwords. The user name can have up to 14 characters supporting alpha and numeric characters. Alpha characters can be entered using the up and down arrow keys. Numeric characters can be selected by using the number keys on the front panel. The user can clear all characters from the front panel screen.

USER RESET Resets group and password.

USER 2

ACCESS GROUP **{NO GROUP, GUEST, OPER, ADMIN}**

Access rights represent the following:

No Group: Denies Access

Guest: Users are able to navigate most of the site, and view modem parameter settings.

Oper: Users can monitor and control parameter settings, and change their own authentication passwords.

Admin: At this highest access right, the users can monitor and control the modems parameters, change any user's name and authentication password, and modify IP network settings. Admin setting allows access to the entire site.

AUTH PASSWORD **{xxxxxxxx}**
User to select password. The user can modify the Authorization Passwords. The user name can have up to 14 characters supporting alpha and numeric characters. Alpha characters can be entered using the up and down arrow keys. Numeric characters can be selected by using the number keys on the front panel. The user can clear all characters from the front panel screen.

USER RESET Resets group and password.

USER 3

ACCESS GROUP **{NO GROUP, GUEST, OPER, ADMIN}**

Access rights represent the following:

No Group: Denies Access

Guest: Users are able to navigate most of the site, and view modem parameter settings.

Oper: Users can monitor and control parameter settings, and change their own authentication passwords.

Admin: At this highest access right, the users can monitor and control the modems parameters, change any user's name and authentication password, and modify IP network settings. Admin setting allows access to the entire site.

AUTH PASSWORD **{xxxxxxxx}**
User to select password. The user can modify the Authorization Passwords. The user name can have up to 14 characters supporting alpha and numeric characters. Alpha characters can be entered using the up and down arrow keys. Numeric characters can be selected by using the number keys on the front panel. The user can clear all characters from the front panel screen.

USER RESET Resets group and password.

HW/FW CONFIG (menu)

FIRMWARE REV Displays the installed firmware revision.

M&C REV Displays the installed Monitor and Control revision.

MAIN BOARD (menu)

Only the appropriate of the VCO adjustment screens listed below will be displayed. These are protected fields, to prohibit accidental changes. To edit the field, the user must depress all four of the direction arrow keys simultaneously.

INT VCO ADJUST **{0% - 100**%}
Allows the user to adjust the internal frequency reference for calibration. **Only displayed of the system reference clock is INTERNAL.**

HI STAB VCO ADJUST **{0% - 100**%}
Allows the user to adjust the internal frequency reference for calibration. **Only displayed if the system reference clock source is HI STABILITY.**

LARGEST HB GAP Used for factory test only.

SOFT RESET **{Enter**}

IF BOARD (menu) Indicates the Radyne part number for the IF Board Assembly.

AGC/CTRL/VALUE **{0% - 100**%}
Allows the user to adjust the internal frequency reference for calibration. **Only displayed if the system reference clock source is HI STABILITY.**

I OFFSET Used for factory test only.

Q OFFSET Used for factory test only.

IF RX LVL OFFSET Used for factory test only.

LB RX LVL OFFSET Used for factory test only.

POWER SOURCE Used for factory test only.

TERR INTFC BRD Indicates the Radyne assembly number for the Terrestrial Interface Assembly.

CODEC BOARD (menu) Indicates the Radyne part number for the Codec Board.

TPC FPGA IMAGE Used for factory test only.

RS FPGA IMAGE Used for factory test only.

TPC CODEC IMAGE Used for factory test only.

FRONT PANEL BOARD Indicates the Radyne assembly number for the front panel board.

FEATURES (menu)

5012.2840.2417 {____.____.____}
Allows the user to install purchased feature upgrades (see Appendix A).
Contact the ustomer Service Department or Sales for hardware and software upgrades.

UPGRADE LIST (menu) The following identifies the available upgrade features:

10 MBPS, 20 MBPS, 52 MBPS (The highest option installed will hide the lower rates.)

RXIF

RXLBAND

TXIF

TXLBAND

ENH ASYNC

IDR

SEQ

RS

RS CUSTOM

IBS

D&I

AUPC

8PSK

16QAM

TURBO 52 MBPS

OM73 SCRAMBLING

DVB

EDMAC

4.4.8 Test Menu Options and Parameters

TX TEST PATTERN **{NONE, 2047, 2^15-1, 2^23-1}**
Allows the user to enable the tests listed above.

RX TEST PATTERN **{NONE, 2047, 2^15-1, 2^23-1}**
Allows the user to enable the tests listed above.

PATTERN SYNC **{YES, NO}**
Yes indicates that the RX Test Pattern is in sync.

TST PAT ERR CNT **{NO SYNC, nnnn x 10^{n}}**
Displays the number of errors detected by the test pattern checker.

TST PATT BER **{NO SYNC, nnnn x 10^{-n}}**
Displays the measured BER for the test pattern.

RESTART TST PAT ((ENTER)) Allows the user to restart the test by pressing <ENTER> on the keypad.

NOTE

LOOPBACK WITH ETHERNET DATA INTERFACE
Usage of the modems loopback capabilities in conjunction with the Ethernet data interface can produce undesirable network loops. In order to run any type of data test with an Ethernet interface you must utilize two modems connected back to back. Simply using one modem and a loopback will not produce the desired results.

LOOPBACK **{IF, TERR TX/RX, BASEBAND TX/RX, NONE, TERR RX, BASEBAND RX, TERR TX, BASEBAND TX, IFEC TX}**
Terrestrial Loopback is performed at the Terrestrial Interface

IF: IF loopback loops the IF output of the Modulator to the IF input of the Demodulator. If using 8PSK or 16QAM Modulation, the output power must be above -15 dB.

TERR TX/RX: Enables both. Baseband loopback is performed at interface between the Baseband Processor Card and the Modem Card. This ensures Framer/Deframer integrity.

BASEBAND TX/RX: Enables both Baseband Tx and Baseband Rx.

***NONE*:** No loopback performed.

TERR RX: (Distant Loop) Sends received satellite data to the Modulator for transmission to the distant end.

BASEBAND RX: Sends Rx data from the Modem Card to the Tx data input to the Modem Card.

TERR TX: Sends Tx Terrestrial Data to Rx data out.

BASEBAND TX: Sends Tx data to the receive input to the BB Card.

Carrier TYPE **{normal, CW, DUAL, OFFSET, POS FIR, NEG FIR}**
Allows the user to set the type of carrier.

NORMAL: Causes the Modulator to output normal modulation.

CW: Causes the Modulator to output a pure carrier.

DUAL: Causes a double sideband output.

OFFSET: Causes a single sideband output.

POS FIR: For manufacturer's use only.

NEG FIR: For manufacturer's use only.

4.5 Terminal Mode Control

The Terminal Mode Control allows the use of an external terminal or computer to monitor and control the modem from a full screen interactive presentation operated by the modem itself. No external software is required other than Terminal Emulation Software (e.g. "Procomm" for a computer when used as a terminal. The Control Port is normally used as an RS–232 Connection to the terminal device. The RS-232 operating parameters can be set using the modem Front Panel and stored in Non-Volatile Memory for future use (refer to Remote Protocol Manual for setup and terminal screens).

Refer to Remote Protocol Manual for terminal screens.

4.5.1 Modem Terminal Mode Control

The modem can be interactively monitored and controlled in the Terminal Mode, with a full screen presentation of current settings and status.

The Terminal Control Mode supports several baud rates, however the connection must be set for 8 data bits, 1 stop bit and no parity (8,N,1).

4.5.2 Modem Setup for Terminal Mode

Terminal Mode Communications and Protocol is set from the Front Panel Control by setting the "Control Mode" Parameter to "Terminal", and then setting the "Modem Port", "Term Baud" and "Emulation" Parameters as desired. Then a terminal is connected to Connector J20 on the Back Panel. All operating software for the Terminal Mode is contained within the Modem Internal Control Software.

A "break" signal on the communications line, pressing "ESC" on the terminal or Power On of the modem will initiate full screen terminal mode printing and redraw the full screen. The Terminal Mode displays the present status of all user parameters controlled and read by the processor, and offers a menu allowing change to any controlled parameter.

The Terminal Mode uses eight "Screens," each of which have the basic contents of the three modem monitor and control areas as set in the Front Panel matrix columns. This screen is used for setting the parameters of the Modulator, Demodulator, Event, Alarm, Latched Alarm, Drop Controls, Insert Controls, and Interface Areas.

4.6 Terminal Port User Interface

The Remote Port (J20) of the modem allows for complete control and monitoring of all parameters and functions via an RS-232 Serial Interface. 'Terminal Mode' can be entered from the front panel by selecting "System" and then "Control Mode" followed by "Terminal". The baud rate and evaluation type can be changed at the front panel by using the *System>Baud Rate* Menu.

The Terminal Control Mode is menu-driven and the allowable values for each item number will be shown. To change an item, type in its number followed by <ENTER>. If the parameter to be changed requires a numeric value, enter the number followed by <ENTER> If the parameter is non-numeric, press <SPACE> to cycle through the list of available entries.

Items that do not have ID numbers are Status only and cannot be changed.

4.7 Connecting the Terminal

1. Connect the computer to the Remote Connector (J20) on the rear of the unit using the RS-232 Cable.

2. Enable the terminal by selecting Terminal Mode (located under the System - Control Mode Menu) from the front panel.

3. Verify that your emulation software is set to the following:

   8 data bits
   no parity
   1 stop bit

   Modify the selection, if necessary, to match the settings (the Front Panel ‘SYSTEM’ Sub-Menu contains all the Terminal Emulation Controls).

4.8 Terminal Screens

For terminal screens, refer to the Remote Protocol Manual.

4.9 RS485 Remote Port Interface (RLLP Protocol)

The Remote Port allows for complete control and monitoring of all parameters and functions via an RS-232 Serial Interface or RS-485 utilizing RLLP Protocol. 'Equipment Remote Mode' can be entered from the GUI interface under the "System" menu by selecting "System" and then "Terminal" followed by "Terminal". The baud rate and evaluation type can be changed at the front panel by using the *System>Baud Rate* Menu.

Control and status messages are conveyed between the modem and all subsidiary modems and the host computer using packetized message blocks in accordance with a proprietary communications specification. This communication is handled by the Radyne Link Level Protocol (RLLP), which serves as a protocol 'wrapper' for the RM&C data. Complete information on monitor and control software is contained in the following sections.

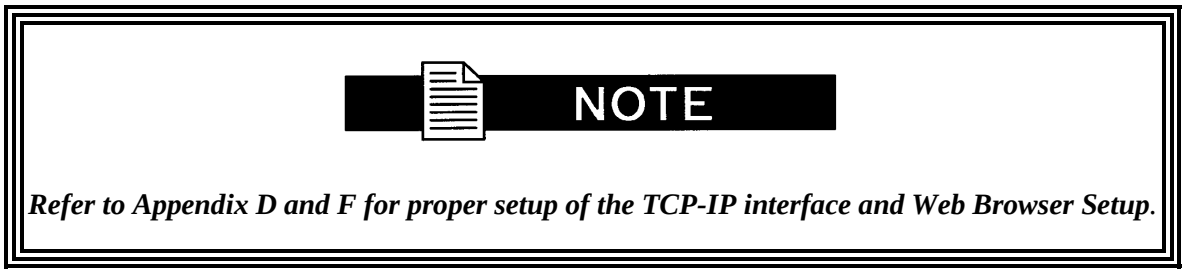
4.9.1 Protocol Structure

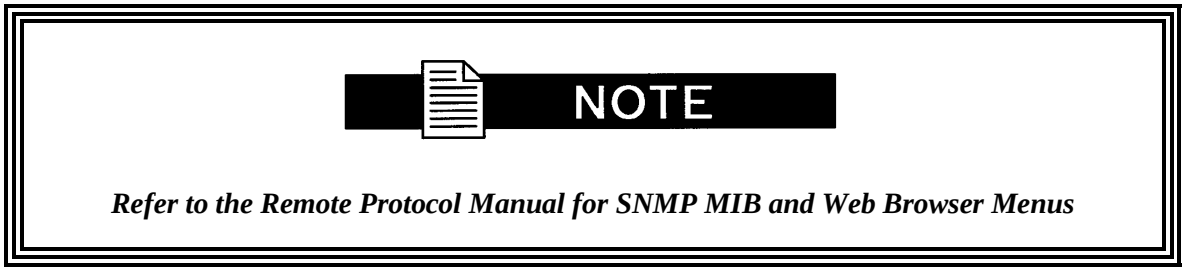
The Communications Specification (COMMSPEC) defines the interaction of computer resident Monitor and Control Software used in satellite earth station equipment such as modems, redundancy switches, multiplexers, and other ancillary support gear. Communication is bi-directional, and is normally established on one or more full-duplex 9600-baud multi-drop control buses that conform to EIA Standard RS-485.

Each piece of earth station equipment on a control bus has a unique physical address, which is assigned during station setup/configuration or prior to shipment. Valid decimal addresses on one control bus range from 032 through 255 supporting up to 224 devices per bus. Address 255 of each control bus is usually reserved for the M&C computer.

4.10 Ethernet Remote Port Interface (SNMP & Web Browser)

This port is dedicated for Ethernet Communications supporting SNMP, FTP and Web Browser. The port is configured for 10 Base-T communications protocols. The Ethernet M&C Interface requires a standard RJ45 Male connector.





Chapter 5. Rear Panel Interfaces

This section discusses the electrical interfaces available from the rear panel. All locations are as viewed from the rear of the unit unless otherwise specified.

5.1 Connections

All connections are made to labeled connectors located on the rear of the unit (refer to Figure 5-1 for the standard unit. Any connection interfacing to the modem must be the appropriate mating connector.

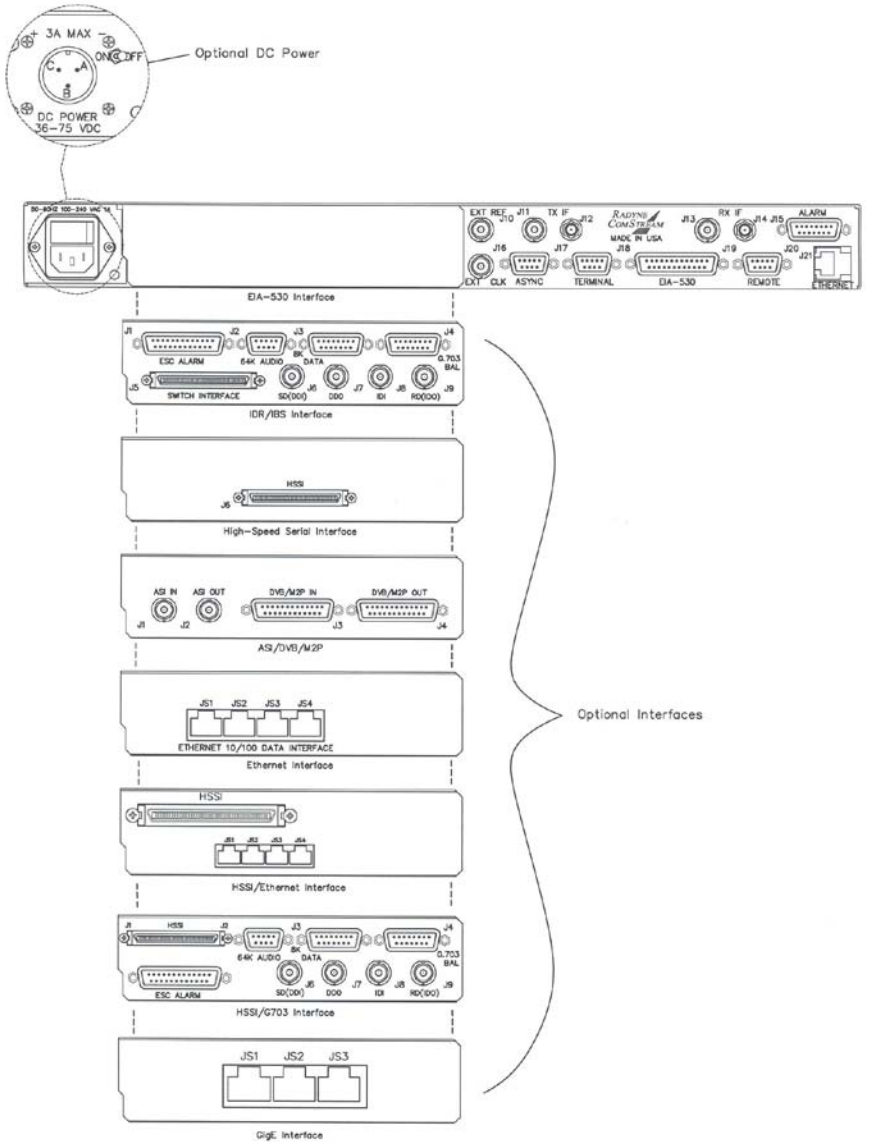


Figure 5-1. Universal Satellite Modem Rear Panel Configurations

5.2 Compact Flash

The compact flash slot is located on the right side as viewed from the rear of the unit. A 128 Mbit flash memory card stores all the modem M&C and operational data. It must be present when the modem is operating.

5.3 Power Input Modules

5.3.1 AC Power Input Module

AC Input Module (Figure 5-1) is located on the left side of the unit. Power applied to the port with the supplied power cable is 100 – 240 VAC, 50 – 60 Hz. Integrated into the Power Input Module is the Power On/Off Rocker Switch. Power consumption for the unit is 1A. A chassis ground connection (#10-32 threaded stud), is located to the lower right of the module.

5.3.2 DC Power Input/Switch

The Optional DC Power Input and Switch (Figure 5-1) is available for all DMD50 products. The unit may be powered from a 48v ± 5vdc VDC source with a maximum unit power consumption of 3 A. Refer to Table 5-1 for pinouts.

Table 5-1. DC Power

DC Power	
A	–
B	Ground
C	+

5.4 Chassis Connections (Standard)

5.4.1 EXT REF (J10)

The External Reference Port is a 50 Ohm Female BNC Connector and will accept the following frequencies: 1.0, 1.544, 2.0, 2.048, 5.0, and 10.0 MHz).

Input level: .1Vpp to 5Vpp (Sine or Square wave)

5.4.2 TX IF (J11)

The Transmit IF Output Port is a 75-Ohm Female BNC Connector that is used for 70/140 MHz IF. The power level is programmable from 0 to -25 dBm in 0.1 dBm steps. The IF Frequency can be programmed to 50 – 90 MHz or 100 – 180 MHz, in 1 Hz Steps.

5.4.3 TX L-Band IF (J12)

The Transmit IF Output Port is a 50-Ohm SMA Female Connector that can be used for L-Band IF. The power level is programmable from 0 to -25 dBm, in 0.1 dBm steps. The IF Frequency can be programmed to 950 – 2050 MHz, in 1 Hz Steps.

5.4.4 RX IF (J13)

The Receive IF Input Port is a 75-Ohm Female BNC Connector that is used for 70/140 MHz IF. If the customer orders the 70/140 MHz IF, the Transmit IF Output Port is a 75-Ohm Female BNC Connector.

5.4.5 RX L-Band IF (J14)

The Receive IF Input Port is a 50-Ohm SMA Female Connector that can be used for L-Band IF. The IF Frequency can be programmed from 950 to 2050 MHz in 1 Hz Steps.

5.4.6 ALARM (J15)

The Alarm Port is a 15-Pin Female "D" Connector. Refer to Table 5-2 for pinouts.

Table 5-2. ALARM Port 15-Pin Female "D" Connector (J15)

Pin No.	Signal Name	Signal	Direction
1	Mod Fault - C	MF-C	No Direction
2	Mod Fault – NC	MF-NC	No Direction
3	Mod Fault – NO	MF-NO	No Direction
4	Demod Fault - C	DF-C	No Direction
5	Demod Fault – NC	DF-NC	No Direction
6	Demod Fault – NO	DF-NO	No Direction
7	Prompt - C	CEF-C	No Direction
8	Prompt – NC	CEF-NC	No Direction
9	Prompt – NO	CEF-NO	No Direction
10	Service – C	SP1-NO	No Direction
11	Service – NC	SP1-NC	No Direction
12	Service – NO	SP2-NO	No Direction
13	No Connection	SP2-NC	No Direction
14	AGC Out	AGC	No Direction
15	Ground	GND	---

5.4.7 EXT CLK (J16)

The External Clock Port is a 75-Ohm Female BNC Connector. It allows interfacing to an external clock source.

Input level: .3 to 5 volts Peak-to-Peak. (Sine or Square wave)

5.4.8 ASYNC (J17)

The Asynchronous Data Interface Port is a 9-Pin Female "D" Connector. Refer to Table 5-3 for pinouts.

Table 5-3. ASYNC Port 9-Pin Female "D" Connector (J17)

Pin No.	Signal Name	Signal	Direction
1	Receive Data B (RS-485)	RXD_B	Output
2	Receive Data A (RS-485/-232)	RXD_A	Output
3	Transmit Data A (RS-485/-232)	TXD_A	Input
4	Transmit Data B (RS-485)	TXD_B	Input
5	Ground	GND	---
6	No Connection	---	---
7	No Connection	---	---
8	No Connection	---	---
9	No Connection	---	---

5.4.9 J18

Factory use only.

5.4.10 EIA-530 (J19)

The EIA-530 Port is an RS-422/V.35/RS-232 Connection. It is a 25-Pin Female "D" Connector. Refer to Table 5-4 for pinouts.

Table 5-4. EIA-530 Port (RS-422/V.35/RS-232) 25-Pin Female "D" Connector (J19)

Pin No.	Signal Name	Signal	Direction
1	Shield	---	---
2	Send Data A (-)	SD-A	Input
3	Receive Data A (-)	RD-A	Output
4	Request To Send A (-)	RS-A	Input
5	Clear To Send A (-)	CS-A	Output
6	Data Mode A (-)	DM-A	Output
7	Signal Ground	SGND	---
8	Receiver Ready A (-)	RR-A	Output

9	Receive Timing B (+)	RT-B	Output
10	Receiver Ready B (+)	RR-B	Output
11	Terminal Timing B (+)	TT-B	Input
12	Send Timing B (+)	ST-B	Output
13	Clear T Send B (+)	CS-B	Output
14	Send Data B (+)	SD-B	Input
15	Send Timing A (-)	ST-A	Output
16	Receive Data B (+)	RD-B	Output
17	Receive Timing A (-)	RT-A	Output
18	Modulator Fault - Open Collector	MF	Output
19	Request To Send B (+)	RS-B	Input
20	Data Terminal Ready A (-)	TR-A	Input
21	Demodulator Fault	DF	Output
22	Data Mode B (+)	DM-B	Output
23	Data Terminal Ready B (+)	TR-B	Input
24	Terminal Timing A (-)	TT-A	Input
25	No Connection	---	---

5.4.11 REMOTE (J20)

The Remote Port is a RS-485 or RS-232 Connection for remote monitor and control of the modem. It is a 9-Pin Female "D" Connector. Refer to Table 5-5 for pinouts.

Table 5-5. Remote Port (RS-485 or RS-232) 9-Pin Female "D" Connector (J20)

Pin No.	Signal Name	Signal	Direction
1	Transmit Data RS-485 (+)	TX-485-B	Output
2	Transmit Data RS-232	TXD-232	Output
3	Receive Data RS-232	RXD-232	Input
4	NC	NC	---
5	Ground	GND	---
6	Transmit Data RS-485 (–)	TX-485-A	Output
7	NC	No Connection	---
8	Receive Data RS-485 (+)	RX-485-B/CTS	Input
9	Receive Data RS-485 (–)	RX-485-A	Input

When operating the remote port as RS232 using a cable pinned 1 for 1 may cause communication failures due to miss routing of standard RS232 com port signals.

When operating the remote port as RS232, the cable used should only have pins 2, 3 and 5 connected.

5.4.12 ETHERNET (J21)

The ETHERNET Port (J21) can be used for the Monitor & Control (M&C) Functions of the unit. The physical interface is a standard female RJ-45 Connector.

5.5 G.703 IDR/IBS Interface (Optional)

The DMD50 supports two versions of the G703 IDR/IBS interface.
Interface options are G703 T1/E1/T2/E2 or G703 T1/E1/T2/E2/E3/T3 and STS1.

5.6 ESC ALARM (J1)

The ESC (Engineering Service Circuits) Alarms Port is a 25-Pin Female "D" Connector. Refer to Table 5-6 for pinouts.

Table 5-6. ESC ALARM Port 25-Pin Female "D" Connector (J1)

Pin No.	Signal Name	Signal	Direction
1	Ground	GND	---
2	Backward Alarm Out - 1NO	ESCBWO 1NO	N/A
3	No Connection	NC	---
4	Backward Alarm Out - 2 NO	ESCBWO 2NO	N/A
5	No Connection	NC	---
6	Backward Alarm Out - 3 NO	ESCBWO 3NO	N/A
7	Ground	GND	---
8	Backward Alarm Out - 4 NO	ESCBWO 4NO	N/A
9	No Connection	NC	---
10	Backward Alarm In - 2	ESCBWI 2	Input
11	Backward Alarm In - 4	ESCBWI 4	Input
12	No Connection	NC	---
13	No Connection	NC	---
14	Backward Alarm Out - 1 C	ESCBWO 1C	N/A
15	Backward Alarm Out - 1 NC	ESCBWO 1NC	N/A
16	Backward Alarm Out - 2 C	ESCBWO 2C	N/A
17	Backward Alarm Out - 2 NC	ESCBWO 2NC	N/A
18	Backward Alarm Out - 3 C	ESCBWO 3C	N/A
19	Backward Alarm Out - 3 NC	ESCBWO 3NC	N/A
20	Backward Alarm Out - 4 C	ESCBWO 4C	N/A
21	Backward Alarm Out - 4 NC	ESCBWO 4NC	N/A
22	Backward Alarm In – 1	ESCBWI 1	Input
23	Backward Alarm In – 3	ESCBWI 3	Input
24	No Connection	NC	---
25	No Connection	NC	---

5.7 64K AUDIO (J2)

The 64K AUDIO Port allows for communications between Earth Stations. It is a 9-Pin Female "D" Connector that complies with IESS 308. Refer to Table 5-7 for pinouts in audio mode and Table 5-8 for pinouts in 64k mode.

Table 5-7. 64K AUDIO (In Audio Mode) Port 9-Pin Female "D" Connector (J2)

Pin No.	Signal Name	Signal	Direction
1	Transmit Audio 1A	ESCAUDTX 1A	Input
2	Receive Audio 1A	ESCAUDRX 1A	Output
3	Ground	GND	---
4	Transmit Audio 2B	ESCAUDTX 2B	Input
5	Receive Audio 2B	ESCAUDRX 2B	Output
6	Transmit Audio 1B	ESCAUDTX 1B	Input
7	Receive Audio 1B	ESCAUDRX 1B	Output
8	Transmit Audio 2A	ESCAUDTX 2A	Input
9	Receive Audio 2A	ESCAUDRX 2A	Output

Table 5-8. 64K AUDIO (In 64K Mode)) Port 9-Pin Female "D" Connector (J2)

Pin No.	Signal Name	Signal	Direction
1	Send Data A	SD-A	Input
2	Receive Data A	RD-A	Output
3	Ground	GND	---
4	Synchronous Data Send Timing B	ST-B	Input
5	Synchronous Data Receive Timing B	RT-B	Output
6	Send Data B	SD-B	Input
7	Receive Data B	RD-B	Output
8	Synchronous Data Send Timing A	ST-A	Input
9	Synchronous Data Receive Timing A	RT-A	Output

5.8 K DATA (J3)

The 8K Data Port allows for communications between Earth Stations. It is a 15-Pin Female "D" Connector that complies with IESS 308. Refer to Table 5-9 for pinouts.

Table 5-9. 8K DATA Port 15-Pin Female "D" Connector (J3)

Pin No.	Signal Name	Signal	Direction
1	Receive Octet-B	ESCRXO-B	Output
2	Receive Clock-B	ESCRXC-B	Output
3	Receive Data-B	ESCRXD-B	Output
4	No Connection	NC	---
5	No Connection	NC	---
6	Transmit Data-A	ESCTXD-A	Input
7	Transmit Clock-A	ESCTXC-A	Output
8	Transmit Octet-A	ESCTXO-A	Output
9	Receive Octet-A	ESCRXO-A	Output
10	Receive Clock-A	ESCRXC-A	Output
11	Receive Data-A	ESCRXD-A	Output
12	Ground	GND	---
13	Transmit Data-B	ESCTXD-B	Input
14	Transmit Clock-B	ESCTXC-B	Output
15	Transmit Octet-B	ESCTXO-B	Output

5.9 G.703 BAL (J4)

The G.703 Interface Port (Balanced) is a 15-Pin Female "D" Connector. Refer to Table 5-10 for pinouts.

Table 5-10. G.703 BAL Port 15-Pin Female "D" Connector (J4)

Pin No.	Signal Name	Signal	Direction
1	Send Data (-)	SD-A	Input
2	Ground	GND	---
3	Receive Data A (-)	RD-A	Output
4	Ground	GND	---
5	Drop Data Out (+)	DDO-B	Output
6	Insert Data In (+) EXC (+)	IDI-B	Input
7	External Clock A (-)	BAL EXC-A	Input
8	External Clock B (+)	BAL EXC-B	Input
9	Send Data (+)	SD-B	Input

10	No Connection	---	---
11	Receive Data B (+)	RD-B	Output
12	Drop Data Out (-)	DDO-A	Output
13	Insert Data In (-) EXC (-)	IDI-A	Input
14	Mod Fault	MOD-FLT	Open Collector Output
15	Demod Fault	DMD-FLT	Open Collector Output

5.9.1 SWITCH INTERFACE (J5)

The Switch Interface Port is a 68-Pin High-Density Female Connector. Refer to Table 5-11 for pinouts.

Table 5-11. SWITCH INTERFACE Port 68-Pin High-Density Female Connector (J5)

Pin No.	Signal Name	Signal	Direction
1	G.703 Send Data Input A	G.703B SD-A	Input
2	Synchronous Data Send Data Input - A	SYNC SD-A	Input
3	IDR ESC Backward Alarm Out - 1 Common	ESCBWO 1C	No Direction
4	G.703 Insert Data Input – A	G.703B IDI-A	Input
5	Synchronous Data Send Timing Output – A	SYNC ST-A	Output
6	IDR ESC Backward Alarm Out - 1 Normally Open	ESCBWO 1NO	No Direction
7	Synchronous Data Terminal Timing Input – A	SYNC TT-A	Input
8	IDR ESC Backward Alarm Out - 2 Normally Closed	ESCBWO 2NC	No Direction
9	G.703 Drop Data Out A - Synchronous Data Receive Timing Output - A	DDO-A RT-A	Output
10	IDR ESC Backward Alarm Output - 3 Common	ESCBWO 3C	No Direction
11	G.703 Insert Data Out A - Synchronous Data Receive Data A	IDO-A RD-A	Output
12	IDR ESC Backward Alarm Output - 3 Normally Open	ESCBWO 3NO	No Direction
13	External Clock Input - A	BAL EXC-A	No Connection
14	Ground	GND	---
15	IDR ESC Audio Input Channel 1A	ESCAUDTX 1A	Input
16	IDR ESC Audio Input Channel 2A	ESCAUDTX 2A	Input
17	IDR ESC Audio Output Channel 1A	ESCAUD RX 1A	Output
18	IDR ESC Audio Output Channel 2A	ESCAUD RX 2A	Output
19	IDR ESC Backward Alarm Input - 3	ESCBWI 3	Input
20	IBS ES Transmit Data A IDR ESC Backward Alarm Input 1	TXD-A BWI 1	Input

Pin No.	Signal Name	Signal	Direction
21	Mod Fault Open Collector Output	MOD FLT	Output Open Collector
22	IBS ES Receive Data Output - A	ES RXD-A	Output
23	IBS ES Data Set Ready (RS-232 Only)	ES DSR	No Connection
24	IDR ESC Transmit 8 Kbps Output Clock	ESCTXC-A	Output
25	IDR ESC Transmit 8 Kbps Output Data	ESCTXD-A	Input
26	IDR ESC Receive 8 Kbps Output Clock	ESCRXC-A	Output
27	IDR ESC Receive 8 Kbps Output Data	ESCRXD-A	Output
28	IDR ESC Backward Alarm Output - 4 Normally Closed	ESCBWO 4NC	No Direction
29	IBS Transmit Octet Input - A	TXO-A	Input
30	Synchronous Data Mode A	SYNC DM-A	Output
31	Synchronous Data Clear to Send - A	SYNC CS-A	Output
32	IBS Receive Octet Output - A	RXO-A	Output
33	Synchronous Data Request to Send - A	SYNC RS-A	Input
34	Synchronous Data Receiver Ready - A	SYNC RR-A	Output
35	G.703 Send Data Input - B	G703B SD-B	Input
36	Synchronous Data Send Data Input - B	SYNC SD-B	Input
37	IDR ESC Backward Alarm Out - 1 Normally Closed	ESCBWO 1 NC	No Direction
38	G.703 Insert Data Input - B	G703B IDI-B	Input
39	Synchronous Data Send Timing Output - B	SYNC ST-B	Output
40	IDR ESC Backward Alarm Out - 2 Common	ESCBWO 2C	No Direction
41	Synchronous Data Terminal Timing – B	SYNC TT-B	Input
42	IDR ESC Backward Alarm Output - 2 Normally Open	ESCBWO 2NO	No Direction
43	G.703 Drop Data Out - B Synchronous Data Receive Timing – B	DDO-B RT-B	Output
44	IDR ESC Backward Alarm Out - 3 Normally Closed	ESCBWO 3NC	No Direction
45	G.703 Insert Data Out Synchronous Data	IDO-B RD-B	Output
46	IDR ESC Backward Alarm Out - 4 Common	ESCBWO 4C	No Direction
47	External Clock Input - B	BAL EXC-B	Input
48	Ground	GND	---
49	IDR ESC Audio Input Channel - 1B	ESCAUDTX 1B	Input
50	IDR ESC Audio Input Channel - 2B	ESCAUDTX 2B	Input
51	IDR ESC Audio Output Channel - 1B	ESCAUDRX 1B	Output
52	IDR ESC Audio Output Channel - 2B	ESCAUDRX 2B	Output
53	IDR ESC Backward Alarm Input - 4	ESCBWI 4	Input
54	IBS ES Transmit Data – B IDR ESC Backward Alarm Input - 2	TX-B BWI 2	Input
55	Demod Fault Open Collector Output	DMD FLT	Output Open Collector
56	IBS ES Receive Data Input - B	ES RXD-B	Output

Pin No.	Signal Name	Signal	Direction
57	Ground	GND	---
58	IDR ESC Transmit 8 Kbps Output Clock - B	ESCTXC-B	Output
59	IDR ESC Transmit 8 Kbps Output Data - B	ESCTXD-B	Input
60	IDR ESC Receive 8 Kbps Clock Output - B	ESCRXC-B	Output
61	IDR ESC Receive 8 Kbps Data Output - B	ESCRXD-B	Output
62	IDR ESC Backward Alarm Out - 4 Normally Open	ESCBWO 4NO	No Direction
63	IBS Transmit Octet Input - B	TXO-B	Input
64	Synchronous Data – Data Mode Out - B	SYNC DM-B	Output
65	Synchronous Data - Clear to Send - B	SYNC CS-B	Input
66	IBS Receive Octet Output - B	RXO-B	Output
67	Synchronous Data Request to Send – B	SYNC RS-B	Input
68	Synchronous Data Receiver Ready - B	SYNC RR-B	Output

5.9.2 SD (DDI) (J6)

The Send Data (Drop Data In) Port (Unbalanced) is a 75-Ohm Female BNC Connector.

5.9.3 DDO (J7)

The Drop Data Out Port (Unbalanced) is a 75-Ohm Female BNC Connector.

5.9.4 IDI (J8)

The Insert Data In Port (Unbalanced) is a 75-Ohm Female BNC Connector.

5.9.5 SD (IDO) (J9)

The Send Data (Insert Data Out) Port (Unbalanced) is a 75-Ohm Female BNC Connector.

5.10 Ethernet Data Interface (Optional)

The optional DMD50 Ethernet Data Interface provides four RJ-45, Auto-Crossover and Auto-Sensing, 10/100 Ethernet Data Ports. JS1 through JS4 may be referred to Port 1 through Port 4 respectively.

5.11 High-Speed Serial Interface (HSSI) (Optional)

5.12 HSSI (J6)

The HSSI (High-Speed Serial Interface) (J6) complies with the HSSI Functional and Electrical Specifications. The physical interface is a 50-Pin SCSI-2 Type Connector. Electrical levels are ECL. Gapped clocking not supported. The pinouts for this interface are listed in Table 5-12.

Table 5-12. J9 – HSSI (High-Speed Serial Interface) 50-Pin Connector

Pin No. (+)	Pin No. (–)	Signal Name	Description	Direction
1	26	SG	Signal Ground	---
2	27	RT	Receive Timing	Output
3	28	CA	DCE Available	Output
4	29	RD	Receive Data	Output
6	31	ST	Send Timing (SCT)	Output
7	32	SG	Signal Ground	---
8	33	TA	DTE Available	Input
9	34	TT	Terminal Timing (SCTE)	Input
11	36	SD	Send Data	Input
13	38	SG	Signal Ground	---
14 - 18	39 – 43	5 Ancillary to DCE	Reserved	Input
19	44	SG	Signal Ground	---
20 - 23	45 - 48	4 Ancillary from DCE	Reserved	Output
24	49	TM	Test Mode	Output
25	N/A	MOD_FLT	Alarm	Output
50	N/A	DMD_FLT	Alarm	Output

5.13 ASI/DVB/M2P Interface (Optional)

5.13.1 ASI IN (J1)

The ASI IN Port (J1) is supported on the BNC Connector. The interface complies with DVB ASI Electrical Specifications.

5.13.2 ASI OUT (J2)

The ASI OUT Port (J2) is supported on the BNC Connector. The interface complies with DVB ASI Electrical Specifications.

5.13.3 DVB/M2P IN (J3)

DVB or M2P IN Port (J3) is supported on the DB-25 female connector. It complies with RS-422 Electrical Specifications. Refer to Table 5-13 for DVB and Table 5-14 for M2P pinouts for this connector.

Table 5-13. J3 – DVB In - 25-Pin Female

Pin Number	Signal Name	Direction
1	CLK+	Input
14	CLK-	Input
2	SYSTEM GND	Input
15	SYSTEM GND	Input
3	D7+	Input
16	D7-	Input
4	D6+	Input
17	D6-	Input
5	D5+	Input
18	D5-	Input
6	D4+	Input
19	D4-	Input
7	D3+	Input
20	D3-	Input
8	D2+	Input
21	D2-	Input
9	D1+	Input
22	D1-	Input
10	D0+	Input
23	D0-	Input
11	DVALID+	Input
24	DVALID-	Input
12	PSYNC+	Input
25	PSYNC-	Input
13	Cable Shield	---

Table 5-14. J3 – M2P In - 25-Pin Female

Pin Number	Signal Name	Direction
1	OUTCLK+	Output
14	OUTCLK-	Output
2	CLK+	Input
15	CLK-	Input
3	SYNC+	Input
16	SYNC-	Input
4	VALID+	Input
17	VALID-	Input
5	D0+	Input
18	D0-	Input
6	D1+	Input
19	D1-	Input
7	D2+	Input
20	D2-	Input
8	D3+	Input
21	D3-	Input
9	D4+	Input
22	D4-	Input
10	D5+	Input
23	D5-	Input
11	D6+	Input
24	D6-	Input
12	D7+	Input
25	D7-	Input
13	Cable Shield	---

5.13.4 DVB/M2P OUT (J4)

The DVB or M2P OUT Port (J4) is also supported on the DB-25 Female Connector. It complies with RS-422 Electrical Specifications. Refer to Table 5-15 for DVB and Table 5-16 for M2P pinouts for this connector.

Table 5-15. J3 - DVB Out 25-Pin Female D Sub Connector

Pin Number	Signal Name	Direction
1	CLK+	Output
14	CLK-	Output
2	SYSTEM GND	Output
15	SYSTEM GND	Output
3	D7+	Output
16	D7-	Output
4	D6+	Output
17	D6-	Output
5	D5+	Output
18	D5-	Output
6	D4+	Output
19	D4-	Output
7	D3+	Output
20	D3-	Output
8	D2+	Output
21	D2-	Output
9	D1+	Output
22	D1-	Output
10	D0+	Output
23	D0-	Output
11	DVALID+	Output
24	DVALID-	Output
12	PSYNC+	Output
25	PSYNC-	Output
13	Cable Shield	---

Table 5-16. J3 - M2P Out 25-Pin Female D Sub Connector

Pin Number	Signal Name	Direction
1	NC	Output
14	NC	Output
2	CLK+	Output
15	CLK-	Output
3	SYNC+	Output
16	SYNC-	Output
4	VALID+	Output
17	VALID-	Output
5	D0+	Output
18	D0-	Output
6	D1+	Output
19	D1-	Output
7	D2+	Output
20	D2-	Output
8	D3+	Output
21	D3-	Output
9	D4+	Output
22	D4-	Output
10	D5+	Output
23	D5-	Output
11	D6+	Output
24	D6-	Output
12	D7+	Output
25	D7-	Output
13	Cable Shield	---

5.14 Ethernet Data Interface (Optional)

The optional DMD50 Ethernet Data Interface provides four RJ-45, Auto-Crossover, Auto-Sensing, 10/100 Ethernet Data Ports where:

JS1 is Port 1
JS2 is Port 2
JS3 is Port 3
JS4 is Port 4

Refer to Figure 5-1 for outline drawings and Appendix E for setup and configuration.

5.15 HSSI / G.703

The HSSI (High-Speed Serial Interface) (J1) complies with the HSSI Functional and Electrical Specifications. The physical interface is a 50-Pin SCSI-2 Type Connector. Electrical levels are ECL. Gapped clocking not supported. The pinouts for this interface are listed in Table 5-17.

Table 5-17. J1 – HSSI (High-Speed Serial Interface) 50-Pin Connector

Pin No. (+)	Pin No. (–)	Signal Name	Description	Direction
1	26	SG	Signal Ground	---
2	27	RT	Receive Timing	Output
3	28	CA	DCE Available	Output
4	29	RD	Receive Data	Output
6	31	ST	Send Timing (SCT)	Output
7	32	SG	Signal Ground	---
8	33	TA	DTE Available	Input
9	34	TT	Terminal Timing (SCTE)	Input
11	36	SD	Send Data	Input
13	38	SG	Signal Ground	---
14 - 18	39 – 43	5 Ancillary to DCE	Reserved	Input
19	44	SG	Signal Ground	---
20 - 23	45 - 48	4 Ancillary from DCE	Reserved	Output
24	49	TM	Test Mode	Output
25	N/A	MOD_FLT	Alarm	Output
50	N/A	DMD_FLT	Alarm	Output

5.15.1 64K AUDIO (J2)

The 64K AUDIO Port allows for communications between Earth Stations. It is a 9-Pin Female "D" Connector that complies to IESS 308. Refer to Table 5-18 for pinouts in audio mode and Table 5-19 for pinouts in 64k mode.

Table 5-18. 64K AUDIO (In Audio Mode) Port 9-Pin Female "D" Connector (J2)

Pin No.	Signal Name	Signal	Direction
1	Transmit Audio 1A	ESCAUDTX 1A	Input
2	Receive Audio 1A	ESCAUDRX 1A	Output
3	Ground	GND	---
4	Transmit Audio 2B	ESCAUDTX 2B	Input
5	Receive Audio 2B	ESCAUDRX 2B	Output
6	Transmit Audio 1B	ESCAUDTX 1B	Input
7	Receive Audio 1B	ESCAUDRX 1B	Output
8	Transmit Audio 2A	ESCAUDTX 2A	Input
9	Receive Audio 2A	ESCAUDRX 2A	Output

Table 5-19. 64K AUDIO (In 64K Mode)) Port 9-Pin Female "D" Connector (J2)

Pin No.	Signal Name	Signal	Direction
1	Send Data A	SD-A	Input
2	Receive Data A	RD-A	Output
3	Ground	GND	---
4	Synchronous Data Send Timing B	ST-B	Input
5	Synchronous Data Receive Timing B	RT-B	Output
6	Send Data B	SD-B	Input
7	Receive Data B	RD-B	Output
8	Synchronous Data Send Timing A	ST-A	Input
9	Synchronous Data Receive Timing A	RT-A	Output

5.15.2 8K DATA (J3)

The 8K Data Port allows for communications between Earth Stations. It is a 15-Pin Female "D" Connector that complies with IESS 308. Refer to Table 5-20 for pinouts.

Table 5-20. 8K DATA Port 15-Pin Female "D" Connector (J3)

Pin No.	Signal Name	Signal	Direction
1	Receive Octet-B	ESCRXO-B	Output
2	Receive Clock-B	ESCRXC-B	Output
3	Receive Data-B	ESCRXD-B	Output
4	No Connection	NC	---
5	No Connection	NC	---
6	Transmit Data-A	ESCTXD-A	Input
7	Transmit Clock-A	ESCTXC-A	Output
8	Transmit Octet-A	ESCTXO-A	Output
9	Receive Octet-A	ESCRXO-A	Output
10	Receive Clock-A	ESCRXC-A	Output
11	Receive Data-A	ESCRXD-A	Output
12	Ground	GND	---
13	Transmit Data-B	ESCTXD-B	Input
14	Transmit Clock-B	ESCTXC-B	Output
15	Transmit Octet-B	ESCTXO-B	Output

5.15.3 G.703 BAL (J4)

The G.703 Interface Port (Balanced) is a 15-Pin Female "D" Connector. Refer to Table 5-21 for pinouts.

Table 5-21. G.703 BAL Port 15-Pin Female "D" Connector (J4)

Pin No.	Signal Name	Signal	Direction
1	Send Data (-)	SD-A	Input
2	Ground	GND	---
3	Receive Data A (-)	RD-A	Output
4	Ground	GND	---
5	Drop Data Out (+)	DDO-B	Output
6	Insert Data In (+) EXC (+)	IDI-B	Input
7	External Clock A (-)	BAL EXC-A	Input
8	External Clock B (+)	BAL EXC-B	Input
9	Send Data (+)	SD-B	Input
10	No Connection	---	---

11	Receive Data B (+)	RD-B	Output
12	Drop Data Out (-)	DDO-A	Output
13	Insert Data In (-) EXC (-)	IDI-A	Input
14	Mod Fault	MOD-FLT	Open Collector Output
15	Demod Fault	DMD-FLT	Open Collector Output

5.15.4 ESC ALARM (J5)

The ESC (Engineering Service Circuits) Alarms Port is a 25-Pin Female "D" Connector. Refer to Table 5-22 for pinouts.

Table 5-22. ESC ALARM Port 25-Pin Female "D" Connector (J1)

Pin No.	Signal Name	Signal	Direction
1	Ground	GND	---
2	Backward Alarm Out - 1NO	ESCBWO 1NO	N/A
3	No Connection	NC	---
4	Backward Alarm Out - 2 NO	ESCBWO 2NO	N/A
5	No Connection	NC	---
6	Backward Alarm Out - 3 NO	ESCBWO 3NO	N/A
7	Ground	GND	---
8	Backward Alarm Out - 4 NO	ESCBWO 4NO	N/A
9	No Connection	NC	---
10	Backward Alarm In - 2	ESCBWI 2	Input
11	Backward Alarm In - 4	ESCBWI 4	Input
12	No Connection	NC	---
13	No Connection	NC	---
14	Backward Alarm Out - 1 C	ESCBWO 1C	N/A
15	Backward Alarm Out - 1 NC	ESCBWO 1NC	N/A
16	Backward Alarm Out - 2 C	ESCBWO 2C	N/A
17	Backward Alarm Out - 2 NC	ESCBWO 2NC	N/A
18	Backward Alarm Out - 3 C	ESCBWO 3C	N/A
19	Backward Alarm Out - 3 NC	ESCBWO 3NC	N/A
20	Backward Alarm Out - 4 C	ESCBWO 4C	N/A
21	Backward Alarm Out - 4 NC	ESCBWO 4NC	N/A
22	Backward Alarm In – 1	ESCBWI 1	Input
23	Backward Alarm In – 3	ESCBWI 3	Input
24	No Connection	NC	---
25	No Connection	NC	---

5.15.5 SD (DDI) (J6)

The Send Data (Drop Data In) Port (Unbalanced) is a 75-Ohm Female BNC Connector.

5.15.6 DDO (J7)

The Drop Data Out Port (Unbalanced) is a 75-Ohm Female BNC Connector.

5.15.7 IDI (J8)

The Insert Data In Port (Unbalanced) is a 75-Ohm Female BNC Connector.

5.15.8 SD (IDO) (J9)

The Send Data (Insert Data Out) Port (Unbalanced) is a 75-Ohm Female BNC Connector.

5.16 HSSI / Ethernet (J1)

The HSSI (High-Speed Serial Interface) (J1) complies with the HSSI Functional and Electrical Specifications. The physical interface is a 50-Pin SCSI-2 Type Connector. Electrical levels are ECL. Gapped clocking not supported. The pinouts for this interface are listed in Table 5-23.

Table 5-23. J1 – HSSI (High-Speed Serial Interface) 50-Pin Connector

Pin No. (+)	Pin No. (–)	Signal Name	Description	Direction
1	26	SG	Signal Ground	---
2	27	RT	Receive Timing	Output
3	28	CA	DCE Available	Output
4	29	RD	Receive Data	Output
6	31	ST	Send Timing (SCT)	Output
7	32	SG	Signal Ground	---
8	33	TA	DTE Available	Input
9	34	TT	Terminal Timing (SCTE)	Input
11	36	SD	Send Data	Input
13	38	SG	Signal Ground	---
14 - 18	39 – 43	5 Ancillary to DCE	Reserved	Input
19	44	SG	Signal Ground	---
20 - 23	45 - 48	4 Ancillary from DCE	Reserved	Output
24	49	TM	Test Mode	Output
25	N/A	MOD_FLT	Alarm	Output
50	N/A	DMD_FLT	Alarm	Output

5.17 Ethernet Data Interface

The DMD50 Ethernet Data Interface provides four RJ-45, Auto-Crossover and Auto-Sensing, 10/100 Ethernet Data Ports. JS1 through JS4 may be referred to Port 1 through Port 4 respectively. Refer to Figure 5-1 for rear panel configurations.

- JS1 is Port 1
- JS2 is Port 2
- JS3 is Port 3
- JS4 is Port 4

Refer to Figure 5-1 for outline and Appendix I for setup & configuration.

5.18 GigE Interface

The optional Ethernet Data Interface provides a three port RJ45 10/100/1000 Base-T Interface. The Ethernet interface supports Auto-Crossover and Auto-Sensing. The Ethernet port are referred to as JS1 through JS4 or JS1 through JS3. Refer to Figures 5-1 for rear panel configurations.

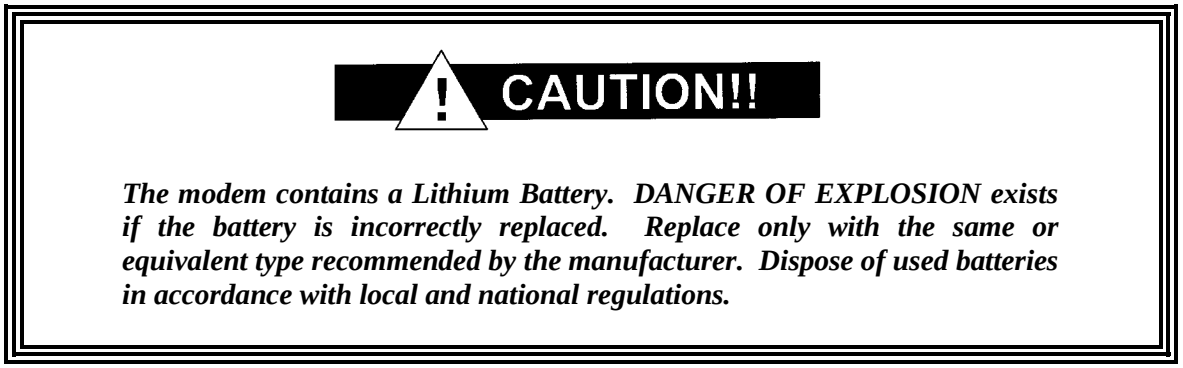
JS1 is Port 1
JS2 is Port 2
JS3 is Port 3

Refer to Figure 5-1 for outline.

Notes:

Chapter 6. Maintenance and Troubleshooting

This section discusses unit maintenance and troubleshooting for the Universal Satellite Modem.


CAUTION!!
The modem contains a Lithium Battery. DANGER OF EXPLOSION exists if the battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries in accordance with local and national regulations.

6.1 Periodic Maintenance

There is no external fuse on the modem. The fuse is located on the power supply assembly inside the case, and replacement is not intended in the field.

6.1.1 Clock Adjustment

The modem allows for VCO speed adjustment from the front panel. Clock adjustment should be performed only when an internal clock source has insufficient accuracy for the custom modem application.

6.2 Troubleshooting

Should a unit be suspected of a defect in field operations after all interface signals are verified, the correct procedure is to replace the unit with another known working unit. If this does not cure the problem, wiring or power should be suspect.

The following is a brief list of possible problems that could be caused by failures of the modem or by improper setup and configuration for the type of service. The list is arranged by possible symptoms exhibited by the modem.

Symptom	Possible Cause
The Modem will not acquire the incoming carrier:	There is an improper receive input to modem.
	The Receive Carrier Level is too low.
	The Receive Carrier Frequency is outside of the acquisition range.
	The Transmit Carrier is incompatible.
	Modem is in Test Mode.
The Async Port is not configured correctly.	The switches may not be set in the correct positions.

6.2.1 Alarm Faults

6.2.1.1 Major Tx Alarms

Alarm	Possible Cause
FPGA CFG	Indicates a transmit FPGA hardware failure.
DSP CFG	Indicates a transmit FPGA failure.
SCT Clock PLL	Indicates that the Tx SCT Clock PLL is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a configuration problem within the modem.
SYM Clock PLL	Indicates that the Tx Symbol Clock PLL is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a problem with the incoming clock to the modem (SCTE).
LB Synth PLL	Indicates that the Tx L-Band Synthesizer is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a configuration problem within the modem.
IF Synth PLL	Indicates that the Tx IF Synthesizer is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a configuration problem within the modem.
Ethernet WAN	Indicates that the WAN Port is down.

6.2.1.2 Major Rx Alarms

Alarm	Possible Cause
FPGA CFG	Indicates a receive FPGA hardware failure.
DSP CFG	Indicates a receive DSP failure.
SIGNAL LOCK	Indicates that the demod is unable to lock to a signal.
FRAME LOCK	Indicates that the Framing Unit is unable to find the expected framing pattern.
MULTIFRAME LOCK	Indicates that the Framing Unit is unable to find the expected framing pattern.
LB SYNTH PLL	Indicates that the Rx L-Band Synthesizer is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a configuration problem within the modem.
IF SYNTH PLL	Indicates that the Rx IF Synthesizer is not locked. This alarm will flash on during certain modem parameter changes. A solid indication points toward a configuration problem within the modem.
Ethernet WAN	Indicates that the WAN Port is down.

6.2.1.3 Minor Tx Alarms

Alarm	Possible Cause
TERR CLK ACT	Indicates no Terrestrial Clock activity.
TERR DATA ACT	Indicates no Tx Data activity.
TX TERR AIS	Indicates that AIS has been detected in the Tx Data Stream.
DnI FRAME LOCK	When running Drop Mode, indicates that the framing unit is unable to find the exported terrestrial framing pattern.
DnI M-FRAME LOCK	When running Drop Mode, indicates that the framing unit is unable to find the exported terrestrial framing pattern.
TX DVB FRAME LOCK	Indicates that the Tx Input Data Stream Framing does not match the user selected Tx Terr Framing. Incorrect Tx Terr Framing selected. Incorrectly framed Tx Input Data Stream.

6.2.1.4 Minor Rx Alarms

Alarm	Possible Cause
BUFF UNDERFLOW	Indicates that a Doppler Buffer underflow has occurred.
BUFF NEAR EMPTY	Indicates that the Doppler Buffer is about to underflow.
BUFF NEAR FULL	Indicates that the Doppler Buffer is about to overflow.
BUFF OVERFLOW	Indicates that a Doppler Buffer overflow has occurred.
RX DATA ACTIVITY	Indicates that there is no Rx Data activity. For the Ethernet Interface, indicates that no Ethernet port is active (no cable is plugged in).
SAT AIS	Indicates that AIS has been detected in the receive satellite data stream.

Alarm	Possible Cause
DnI FRAME LOCK	Indicates if drop/insert data is frame locked.
DnI M-FRAME LOCK	Indicates if drop/insert data has multiframe lock.
INSERT CRC	Indicates if the Circular Redundancy Check is passing in PCM-30C and PCM-31C Modes.
T1/E1 SIGNALING	Indicates that the T1/E1 Signal is not locked.
IFEC LOCK	Indicates that the Inner Codec is not locked.
OFEC LOCK	Indicates that the Reed-Solomon Decoder is not locked.
INTERLEAVER	Indicates that the Reed Solomon Interleaver is not synchronized.
EBNO (dB)	Indicates that the Eb/No is outside of limits.
IBS BER	Indicates that there are more than one in 1000 bits in error in IBS mode.
RX DVB FRAME LOCK	Indicates that the Rx Satellite Data Stream Framing is not DVB.

6.2.1.5 Drop and Insert Alarms

Alarm	Possible Cause
Multiframe Lock	The insert framer is not in sync.
CRC Lock	An Insert CRC Fault occurred. Valid in T1-ESF, PCM-30, or PCM-30C Modes.
T1 Signaling	An Insert T1 Yellow Fault occurred. Valid in T1-ESF, T1D4, or SCL-96 Modes.
E1 FAS (E1 Frame Acquisition Sync)	An E1 FAS Fault occurred. Valid in PCM-30, or PCM-30C, PCM-31, or PCM-31C Modes.
E1 MFAS (E1 Multi-Frame Acquisition Sync)	An E1 MFAS Fault occurred. Valid in PCM-30, or PCM-30C, PCM-31, or PCM-31C Modes.

6.2.1.6 Common Major Alarms

Alarm	Possible Cause
TERR FPGA CFG	Indicates an Interface Card FPGA configuration failure probably caused by a missing, or wrong file.
CODEC FPGA CFG	Indicates Turbo Codec Card FPGA configuration failure probably caused by a missing, or wrong file.
+1.5V RX SUPPLY	Displays the measured voltage of the 1.5 Volt Rx power bus located inside the modem.
+1.5V TX SUPPLY	Displays the measured voltage of the 1.5 Volt Tx power bus located inside the modem.
+3.3V SUPPLY	Displays the measured voltage of the +3.3 Volt power bus located inside the modem.
+5V SUPPLY	Displays the measured voltage of the +5 Volt power bus located inside the modem.
+12V SUPPLY	Displays the measured voltage of the +12 Volt power bus located inside the modem.

+20V SUPPLY	Displays the measured voltage of the +20 Volt power bus located inside the modem.
EXT CLOCK ACT	Indicates that the External Clock is not active.
EXT REF ACT	Indicates no activity on the External Reference.
EXT REF LOCK	Indicates that the External Reference PLL is not locked.

6.2.2 Alarm Masks

The modem performs a high degree of self-monitoring and fault isolation. The alarms for these faults are separated into the following three categories:

- Active Alarms
- Common Equipment Alarms
- Backward Alarms

A feature exists that allows the user to 'Mask' out certain alarms as explained below.

When an alarm is masked, the Front Panel LEDs and the Fault Relays do not get asserted, but the Alarm will still be displayed. This feature is very helpful during debugging or to lock out a failure of which the user is already aware.

6.2.2.1 Active Alarms

6.2.2.1.1 Major Alarms

Major Alarms indicate a modem hardware failure. Major Alarms may flash briefly during modem configuration changes and during power-up but should not stay illuminated. Alarms are grouped into Transmit and Receive Alarms - Transmit and Receive are completely independent.

6.2.2.1.2 Minor Alarms

Minor Alarms indicate that a problem may persist outside the modem such as loss of Terrestrial Clock, loss of terrestrial data activity, or a detected transmit or receive AIS condition.
Alarms are grouped into Transmit and Receive Alarms - Transmit and Receive are completely independent.

6.2.2.1.3 Common Equipment Faults

Common equipment faults indicate hardware or configuration problems in the modem that effect both transmit and receive operation. Most common faults indicate a hardware failure within the modem, such as a bad power supply. Common faults for the External Reference and External Clock indicate a bad modem configuration, not a hardware failure.

6.2.2.2 Latched Alarms

Latched Alarms are used to catch intermittent failures. If a fault occurs, the fault indication will be latched even if the alarm goes away. After the modem is configured and running, it is recommended that the Latched Alarms be cleared as a final step.

6.2.2.3 Backward Alarms

Backward Alarms are alarms that are fed back to or received from the other end of the satellite link. In IBS Mode (including Drop & Insert), Backward Alarm 1 is the only one used. It would be received if the distant end demod drops lock.

6.3 IBS Fault Conditions and Actions

Figure 6-1 and Table 6-1 illustrate the IBS Fault Conditions and Actions to be taken at the Earth Station, at the Terrestrial Data Stream, and the Satellite. These faults include those detected on the Terrestrial link and those detected from the satellite.

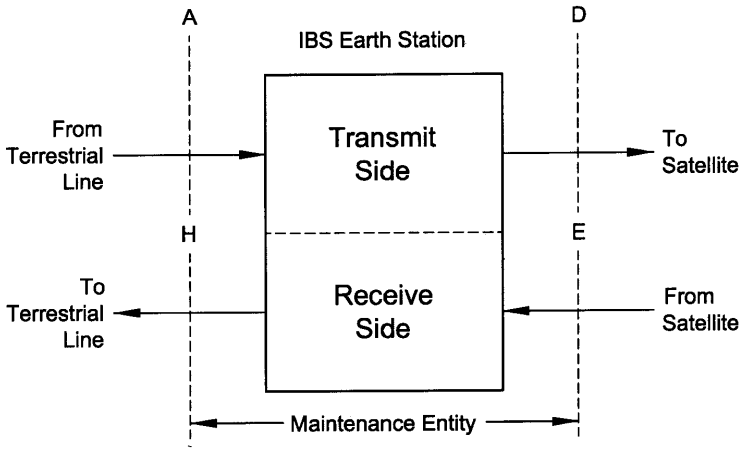


Figure 6-1. IBS Alarm Concept

Table 6-1. IBS Fault Conditions and Actions (includes Drop and Insert)

Fault Detected on Terrestrial Link (Across Interface A)	Action In Earth Station	Action to Terrestrial (Across Interface H)	Action to Satellite (Across Interface D)
FA1 - Loss of Terrestrial Input	AS1, 2 - IBS Prompt, Service Alarm	AH2 - '1' in Bit 3 of NFAS TSO, Yellow Alarm	AD1 - AIS in Relevant TSs
FA2 - Loss of Terrestrial Signaling	AS1 - - IBS Prompt Alarm	AH2 - '1' in Bit 3 of NFAS TSO, Yellow Alarm	AD3 - '1111' in RelevantTS16's
FA3 - Loss of Terrestrial Frame	AS1 - - IBS Prompt Alarm	AH2 - '1' in Bit 3 of NFAS TSO, Yellow Alarm	AD1 - AIS in Relevant TSs
FA4 - Loss of Terrestrial Multiframe	AS1 - IBS Prompt Alarm	AH2 - '1' in Bit 3 of NFAS TSO, Yellow Alarm	AD3 - '1111' in Relevant TS16's
FA5 - BER of 1x 10^{-3} or Greater on Terrestrial Input	AS1 - IBS Prompt Alarm	AH2 - '1' in Bit 3 of NFAS TSO, Yellow Alarm	AD1 - AIS in Relevant TSs
FA6 - Alarm Indication Received on Terrestrial Input	---	---	AD2 - '1' in Bit 3 of Byte 32
Fault Detected From Satellite (Across Interface E)			
FA1 - Loss of Satellite Signal Input	AS1, 2 - IBS Prompt, Service Alarm	AH1, 3 - AIS in TSs, '1111' in TS16	AD2 - '1' in Bit 3 of Byte 32
FA2 - Loss of Satellite Frame	AS1, 2 - IBS Prompt, Service Alarm	AH1, 3 - AIS in TSs, '1111' in TS16	AD2 - '1' in Bit 3 of Byte 32
FA3 - Loss of Satellite Multiframe	AS1, 2 - IBS Prompt, Service Alarm	AH1, 3 - AIS in TSs, '1111' in TS16	AD2 - '1' in Bit 3 of Byte 32
FA4 - BER of 1E-3 or Greater From Satellite Input	AS1, 2 - IBS Prompt, Service Alarm	AH1, 3 - AIS in TSs, '1111' in TS16	AD2 - '1' in Bit 3 of Byte 32
FA5 - Alarm Indication Received From Satellite Input	AS2 - IBS Service Alarm	AH2 - '1' in Bit 3 of NFAS TS0, Yellow Alarm	---

Notes:

Chapter 7. Technical Specifications

7.1 Data Rates

BPSK Uncoded	4.8 Kbps to 10.0 Mbps
1/2 Rate BPSK	2.4 Kbps to 10.0 Mbps
3/4 Rate BPSK	3.6 Kbps to 10.0 Mbps
7/8 Rate BPSK	4.2 Kbps to 10.0 Mbps
QPSK Uncoded	9.6 Kbps to 20.0 Mbps
1/2 Rate QPSK	4.8 Kbps to 20.0 Mbps
3/4 Rate QPSK	7.2 Kbps to 20.0 Mbps
7/8 Rate QPSK	8.4 Kbps to 20.0 Mbps
2/3 Rate 8PSK	9.6 Kbps to 52.0 Mbps
3/4 Rate 8PSK	10.8 Kbps to 20.0 Mbps
7/8 Rate 8PSK	12.6 Kbps to 20.0 Mbps
2/3 Rate 8QAM	36.0 Kbps to 20.0 Mbps
3/4 Rate 8QAM	40.5 Kbps to 20.0 Mbps
7/8 Rate 8QAM	48.0 Kbps to 20.0 Mbps
3/4 Rate 16QAM	14.4 Kbps to 52.0 Mbps
7/8 Rate 16QAM	16.84 Kbps to 52.0 Mbps

7.2 Modulator

Modulation	BPSK, QPSK, OQPSK, 8PSK, 8QAM, 16QAM
IF Tuning Range	50 to 90, 100 to 180 MHz in 1 Hz Steps
L-Band Tuning Range	950 to 2050 MHz in 1 Hz Steps
Impedance	IF, 75 Ohm (50 Ohm Optional) L-Band, 50 Ohm
Connector	BNC, 75 Ohm SMA, 50 Ohm, L-Band
Return Loss	IF, 1.5:1 L-Band, 2.0:1
Output Power	0 to -25 dB
Output Stability	IF, ±0.5 dB Over Frequency and Temperature L-Band, ±1.0 dB Over Frequency and Temperature
Output Spectrum	Meets IESS 308/309/ 310 Power Spectral Mask
Spurious	-55 dBc In-Band (50 to 90 MHz, 100 to 180 MHz, 950 to 2050 MHz) -45 dBc Out-of-Band
On/Off Power Ratio	>60 dB
Scrambler	OM-73, CCITT V.35 or IBS
FEC	Viterbi, K = 7 at 1/2, 3/4 and 7/8

	2/3 Rate Trellis Turbo Product Code (Optional) – (SuperCard ONLY) BPSK 21/44 QPSK/OQPSK 1/2, 3/4, 7/8 <20Mbps 8PSK 3/4/, 7/8 <20Mbps 16QAM 3/4, 7/8 <20Mbps QPSK/OQPSK .750, .875 >20Mbps 8PSK/16QAM .750, .875 >20Mbps Legacy Turbo Rates: 0.495, 0.793 LDPC/TPC (Optional) BPSK 1/2 <20Mbps (LDPC) QPSK/OQPSK 1/2, 2/3, 3/4 <20Mbps (LDPC) 8PSK/8QAM 2/3, 3/4 <20Mbps (LDPC) 16QAM 3/4 <20Mbps (LDPC) BPSK 21/44 (TPC) QPSK/OQPSK 1/2, 2/3, 3/4, 7/8 <20Mbps (TPC) 8QAM/8PSK 2/3, 3/4, 7/8 <20Mbps (TPC) 16QAM 3/4, 7/8 <20Mbps (TPC)
Outer Encoder Options	Reed-Solomon INTELSAT (DVB Optional) Custom (N, K) Reed-Solomon
Data Clock Source	Internal, External, Rx Recovered
Internal Stability	5×10^{-8}

7.3 Demodulator

Demodulation	BPSK, QPSK, OQPSK, 8PSK, 8QAM, 16QAM
IF Tuning Range	50 to 90, 100 to 180 MHz in 1 Hz Steps
L-Band Tuning Range	950 to 2050 MHz in 1 Hz Steps
Impedance	IF, 75 Ohm (50 Ohm Optional) L-Band, 50 Ohm
Connector	BNC, 75 Ohm SMA, 50 Ohm, L-Band
Return Loss	IF, 1.5:1 L-Band, 2.0:1
Spectrum	Meets INTELSAT IESS 308/309/310 Compliant
Input Level	-55 to +10 dBm
Total Input Power	+5 dBm or +40 dBc (the Lesser)
FEC	Viterbi, K = 7 at 1/2, 3/4 and 7/8 2/3 Rate Trellis Turbo Product Code (Optional) – (SuperCard ONLY) BPSK 21/44 QPSK/OQPSK 1/2, 3/4, 7/8 <20Mbps 8PSK 3/4/, 7/8 <20Mbps 16QAM 3/4, 7/8 <20Mbps QPSK/OQPSK .750, .875 >20Mbps 8PSK/16QAM .750, .875 >20Mbps Legacy Turbo Rates: 0.495, 0.793 LDPC/TPC (Optional) BPSK 1/2 <20Mbps (LDPC) QPSK/OQPSK 1/2, 2/3, 3/4 <20Mbps (LDPC) 8PSK/8QAM 2/3, 3/4 <20Mbps (LDPC) 16QAM 3/4 <20Mbps (LDPC)

	BPSK 21/44 (TPC) QPSK/OQPSK 1/2, 2/3, 3/4, 7/8 <20Mbps (TPC) 8QAM/8PSK 2/3, 3/4, 7/8 <20Mbps (TPC) 16QAM 3/4, 7/8 <20Mbps (TPC)
Decoder Options	Reed-Solomon INTELSAT (DVB Optional) Custom (N, K) Reed-Solomon
Descrambler	OM-73, CCITT V.35 or IBS
Acquisition Range	Programmable ±1 kHz to ± 255 kHz
Reacquisition Range	Programmable ±1 Hz to 25000 Hz
Sweep Delay Value	0 to 6000 seconds in 100 msec Steps

7.4 Plesiochronous Buffer

Size	0 msec to 64 msec
Centering	Automatic on Underflow/Overflow
Centering Modes	IBS: Integral Number of Frames IDR: Integral Number of Multi-Frames
Clock	Transmit, External, Rx Recovered or SCT (Internal)

7.5 Monitor and Control

Ethernet 10 Base-T/Web Browser, Remote RS-485/Terminal RS-232/DMD15 Protocol Compatible

7.6 DMD50 Drop and Insert (Optional)

Terrestrial Data	1.544 Mbps or 2.048 Mbps, G.732/733
Line Coding	AMI or B8ZS for T1 and HDB3 for E1
Framing	D4, ESF and PCM-30 (PCM-30C) or PCM-31 (PCM- 31C) for E1
Time Slot Selection	n x 64 Contiguous or Arbitrary Blocks for Drop or Insert.
Time Slots	TS1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, 30, 31
Data Rates	64, 128, 192, 256, 320, 384, 512, 640, 768, 960, 1024, 1280, 1536, 1920 Kbps
Efficient D&I	Closed Network, Satellite Overhead 0.4%
Time Slots	1-31 Any combination

7.7 Terrestrial Interfaces

A variety of standard interfaces are available for the DMD50 modem in stand-alone applications.

7.8 IDR/ESC T2/E2 Interface (Optional)

G.703 T1 (100)	1.544 Mbps, 100 Ohm Balanced, AMI and B8ZS
G.703 E1	2.048 Mbps, 75 Ohm Unbalanced and 120 Ohm Balanced, HDB3
G.703 T2 (100)	6.312 Mbps, 75 Ohm Unbalanced and 110 Ohm Balanced, B8ZS and B6ZS
G.703 E2	8.448 Mbps, 75 Ohm BNC, Unbalanced, HDB3

7.9 IDR/ESC T3/E3/STS1 Interface (Optional)

G.703 T1 (DSX1)	1.544 Mbps, 100-Ohm Balanced, AMI and B8ZS
G.703 E1	2.048 Mbps, 75-Ohm BNC, Unbalanced and 120-Ohm Balanced, HDB3
G.703 T2 (DSX2)	6.312 Mbps, 75-Ohm BNC, Unbalanced and 110-Ohm Balanced, B8ZS and B6ZS
G.703 E2	8.448 Mbps, 75-Ohm BNC, Unbalanced, HDB3
G.703 E3	34.368 Mbps, 75-Ohm BNC, Unbalanced

G.703 T3	44.736 Mbps, 75-Ohm BNC, Unbalanced
G.703 STS1	51.84Mbps, 75-Ohm BNC, Unbalanced

7.10 IBS/Synchronous Interface (Standard)

MIL-188-144A/RS-422/-530	All Rates, Differential, Clock/Data, DCE
ITU V.35	All Rates, Differential, Clock/Data, DCE
RS-232	(DCE up to 200 Kbps)

7.11 High-Speed Serial Interface (HSSI)

HSSI:	HSSI, Serial, 50-Pin SCSI-2 Type Connector (Female)

7.12 ASI

ASI:	ASI, Serial, 75 Ohm BNC (Female)
RS-422 Parallel:	DVB/M2P, Parallel, RS-422, DB-25 (Female)
ASI:	ASI, Serial, 75 Ohm BNC (Female)
LVDS Parallel:	DVB/M2P, Parallel, LVDS, DB-25 (Female)

7.13 DVB/M2P

DVB/M2P:	DB-25 Female Connector. It complies with RS-422 Electrical Specifications.

7.14 Ethernet Data Interface (Optional)

Ethernet Data Interface	Four RJ-45, Auto-Crossover, Auto-Sensing, 10/100 Ethernet Data Ports. Complies with IEEE 802.3 and IEEE 802.3u.

7.15 Gigi Ethernet Data Interface (Optional)

Ethernet Data Interface	Three RJ-45, Auto-Crossover, Auto-Sensing, 10/100/1000 Ethernet Data Ports. Complies with IEEE 802.3 and IEEE 802.3u.

7.16 HSSI / G703 T2/E2 Max

HSSI	High-Speed Serial Interface, 50-pin SCSI-2 Type Connector (Female)
G.703 T1 (DSX1)	1.544 Mbps, 100-Ohm Balanced, AMI and B8ZS
G.703 E1	2.048 Mbps, 75-Ohm Unbalanced and 120-Ohm Balanced, HDB3
G.703 T2 (DSX2)	6.312 Mbps, 75-Ohm Unbalanced and 110-Ohm Balanced, B8ZS and B6ZS
G.703 E2	8.448 Mbps, 75-Ohm BNC, Unbalanced, HDB3 **Note:** Does not support backward alarms

7.17 HSSI / G703 T3/E3/STS1 Max

HSSI	High-Speed Serial Interface, 50-pin SCSI-2 Type Connector (Female)
G.703 T1 (DSX1)	1.544 Mbps, 100-Ohm Balanced, AMI and B8ZS
G.703 E1	2.048 Mbps, 75-Ohm Unbalanced and 120-Ohm Balanced, HDB3
G.703 T2 (DSX2)	6.312 Mbps, 75-Ohm Unbalanced and 110-Ohm Balanced, B8ZS and B6ZS

G.703 E2	8.448 Mbps, 75-Ohm BNC, Unbalanced, HDB3
G.703 E3	34.368 Mbps, 75-Ohm BNC, Unbalanced
G.703 T3	44.736 Mbps, 75-Ohm BNC, Unbalanced
G.703 STS1	51.84Mbps, 75-Ohm BNC, Unbalanced **Note:** Does not support backward alarms

7.18 HSSI /ETHERNET

HSSI Connector (Female)	HSSI, High-Speed Serial Interface, 50-pin SCSI-2 Type
Ethernet Data Interface	Four RJ-45, Auto-Crossover, Auto-Sensing, 10/100 Ethernet Data Ports. Complies with IEEE 802.3 and IEEE 802.3u.

7.19 Environmental

Prime Power	100 to 240 VAC, 50 to 60 Hz, 250 Watts Maximum 48 VDC (Optional)
Operating Temperature	-10 to +60°C, 95% Humidity, Non-Condensing
Storage Temperature	-20 to 70°C, 99% humidity, Non-Condensing

7.20 Physical

Size	19” W x 19.25” D x 1.75” H (48.26 x 48.89 x 4.45 cm)
Weight	6.5 Pounds (3.0 Kg)

7.21 DMD50 Data Rate Limits

7.21.1 Non-DVB

Modulation	Code Rate	Min Data Rate	Max Data Rate	Option Card
BPSK	NONE	4800	10000000	
BPSK	VIT 1/2	2400	10000000	
BPSK	VIT 3/4	3600	10000000	
BPSK	VIT 7/8	4200	10000000	
BPSK	SEQ 1/2	2400	2048000	
BPSK	SEQ 3/4	3600	2048000	
BPSK	SEQ 7/8	4200	2048000	
BPSK	TPC 21/44	2400	4772727	Supercard
BPSK	TPC 3/4	4800	7500000	Supercard
BPSK	TPC 7/8	4800	8750000	Supercard
BPSK	TPC .495	2376	4950000	Supercard
BPSK	TPC .793	3806	7930000	Supercard
BPSK	TPC 21/44	18000	477000	LDPC/TPC Card
BPSK	LDPC 1/2	18000	6250000	LDPC/TPC Card
QPSK	NONE	9600	20000000	
QPSK	VIT 1/2	4800	20000000	
QPSK	VIT 3/4	7200	20000000	
QPSK	VIT 7/8	8400	20000000	
QPSK	SEQ 1/2	4800	2048000	
QPSK	SEQ 3/4	7200	2048000	
QPSK	SEQ 7/8	8400	2048000	
QPSK	TPC 1/2	4582	9545454	Supercard
QPSK	TPC 3/4	7200	15000000	Supercard
QPSK	TPC 7/8	8400	17500000	Supercard
QPSK	TPC .750	20000001	39000000	Supercard
QPSK	TPC .875	20000001	45500000	Supercard
QPSK	TPC .495	4752	6312000	Supercard
QPSK	TPC .793	7612	6312000	Supercard
QPSK	LDPC 1/2	18000	10000000	LDPC/TPC Card
QPSK	LDPC 2/3	24000	13333000	LDPC/TPC Card

QPSK	LDPC 3/4	27000	15000000	LDPC/TPC Card
QPSK	TPC 1/2	18000	9545400	LDPC/TPC Card
QPSK	TPC 3/4	27000	15000000	LDPC/TPC Card
QPSK	TPC 7/8	31500	17500000	LDPC/TPC Card
OQPSK	NONE	9600	20000000	
OQPSK	VIT 1/2	4800	20000000	
OQPSK	VIT 3/4	7200	20000000	
OQPSK	VIT 7/8	8400	20000000	
OQPSK	SEQ 1/2	4800	2048000	
OQPSK	SEQ 3/4	7200	2048000	
OQPSK	SEQ 7/8	8400	2048000	
OQPSK	TPC 1/2	4582	9545454	Supercard
OQPSK	TPC 3/4	7200	15000000	Supercard
OQPSK	TPC 7/8	8400	17500000	Supercard
OQPSK	TPC .750	20000001	39000000	Supercard
OQPSK	TPC .875	20000001	45500000	Supercard
OQPSK	TPC .495	4752	6312000	Supercard
OQPSK	TPC .793	7612	6312000	Supercard
OQPSK	LDPC 1/2	18000	10000000	LDPC/TPC Card
OQPSK	LDPC 2/3	24000	13333000	LDPC/TPC Card
OQPSK	LDPC 3/4	27000	15000000	LDPC/TPC Card
OQPSK	TPC 1/2	18000	9545400	LDPC/TPC Card
OQPSK	TPC 3/4	27000	15000000	LDPC/TPC Card
OQPSK	TPC 7/8	31500	17500000	LDPC/TPC Card
8PSK	TRE 2/3	9600	52000000	
8PSK	TPC 3/4	10800	20000000	Supercard
8PSK	TPC 7/8	12600	20000000	Supercard
8PSK	TPC .495	9504	6312000	Supercard
8PSK	TPC .793	15225	6312000	Supercard
8PSK	TPC .750	20000001	52000000	Supercard
8PSK	TPC .875	20000001	52000000	Supercard
8PSK	LDPC 2/3	36000	20000000	LDPC/TPC Card
8PSK	LDPC 3/4	40500	20000000	LDPC/TPC Card
8QAM	TPC 2/3	36000	20000000	LDPC/TPC Card

8QAM	TPC 3/4	40500	20000000	LDPC/TPC Card
8QAM	TPC 7/8	48000	20000000	LDPC/TPC Card
8QAM	LDPC 2/3	36000	20000000	LDPC/TPC Card
8QAM	LDPC 3/4	40500	20000000	LDPC/TPC Card
16QAM	VIT 3/4	14400	20000000	
16QAM	VIT 7/8	16800	20000000	
16QAM	TPC 3/4	14400	20000000	Supercard
16QAM	TPC 7/8	16800	20000000	Supercard
16QAM	TPC .495	9504	6312000	Supercard
16QAM	TPC .793	15225	6312000	Supercard
16QAM	TPC .750	20000001	52000000	Supercard
16QAM	TPC .875	20000001	52000000	Supercard
16QAM	LDPC 3/4	54000	20000000	LDPC/TPC Card
16QAM	TPC 3/4	54000	20000000	LDPC/TPC Card
16QAM	TPC 7/8	63000	20000000	LDPC/TPC Card

7.21.2 DVB

187 Mode			
Modulation	**Code Rate**	**Min Data Rate**	**Max Data Rate**
BPSK	VIT 1/2	2400	4583333
BPSK	VIT 2/3	2934	6111111
BPSK	VIT 3/4	3300	6875000
BPSK	VIT 5/6	3667	7638888
BPSK	VIT 7/8	3850	8020833
QPSK	VIT 1/2	4400	9166666
QPSK	VIT 2/3	5867	12222222
QPSK	VIT 3/4	6600	13750000
QPSK	VIT 5/6	7334	15277777
QPSK	VIT 7/8	7700	16041666
8PSK	TRE 2/3	8800	18333333
8PSK	TRE 5/6	11000	20000000
8PSK	TRE 8/9	11550	20000000
16QAM	TRE 3/4	13200	20000000
16QAM	TRE 7/8	15400	20000000

188 Mode			
Modulation	**Code Rate**	**Min Data Rate**	**Max Data Rate**
BPSK	VIT 1/2	2400	4607843
BPSK	VIT 2/3	2950	6143790
BPSK	VIT 3/4	3318	6911764
BPSK	VIT 5/6	3687	7679738
BPSK	VIT 7/8	3871	8063725
QPSK	VIT 1/2	4424	9215686
QPSK	VIT 2/3	5899	12287581
QPSK	VIT 3/4	6636	13823529
QPSK	VIT 5/6	7373	15359476
QPSK	VIT 7/8	7742	16127450
8PSK	TRE 2/3	8848	18431372
8PSK	TRE 5/6	11059	20000000
8PSK	TRE 8/9	11797	20000000
16QAM	TRE 3/4	13271	20000000
16QAM	TRE 7/8	15483	20000000

204 Mode			
Modulation	**Code Rate**	**Min Data Rate**	**Max Data Rate**
BPSK	VIT 1/2	2400	5000000
BPSK	VIT 2/3	3200	6666666
BPSK	VIT 3/4	3600	7500000
BPSK	VIT 5/6	4000	8333333
BPSK	VIT 7/8	4200	8750000
QPSK	VIT 1/2	4800	10000000
QPSK	VIT 2/3	6400	13333333
QPSK	VIT 3/4	7200	15000000
QPSK	VIT 5/6	8000	16666666
QPSK	VIT 7/8	8400	17500000
8PSK	TRE 2/3	9600	20000000
8PSK	TRE 5/6	12000	20000000
8PSK	TRE 8/9	12800	20000000
16QAM	TRE 3/4	14400	20000000
16QAM	TRE 7/8	16800	20000000

7.22 DMD50 BER Specifications

7.22.1 BER Performance (Viterbi)

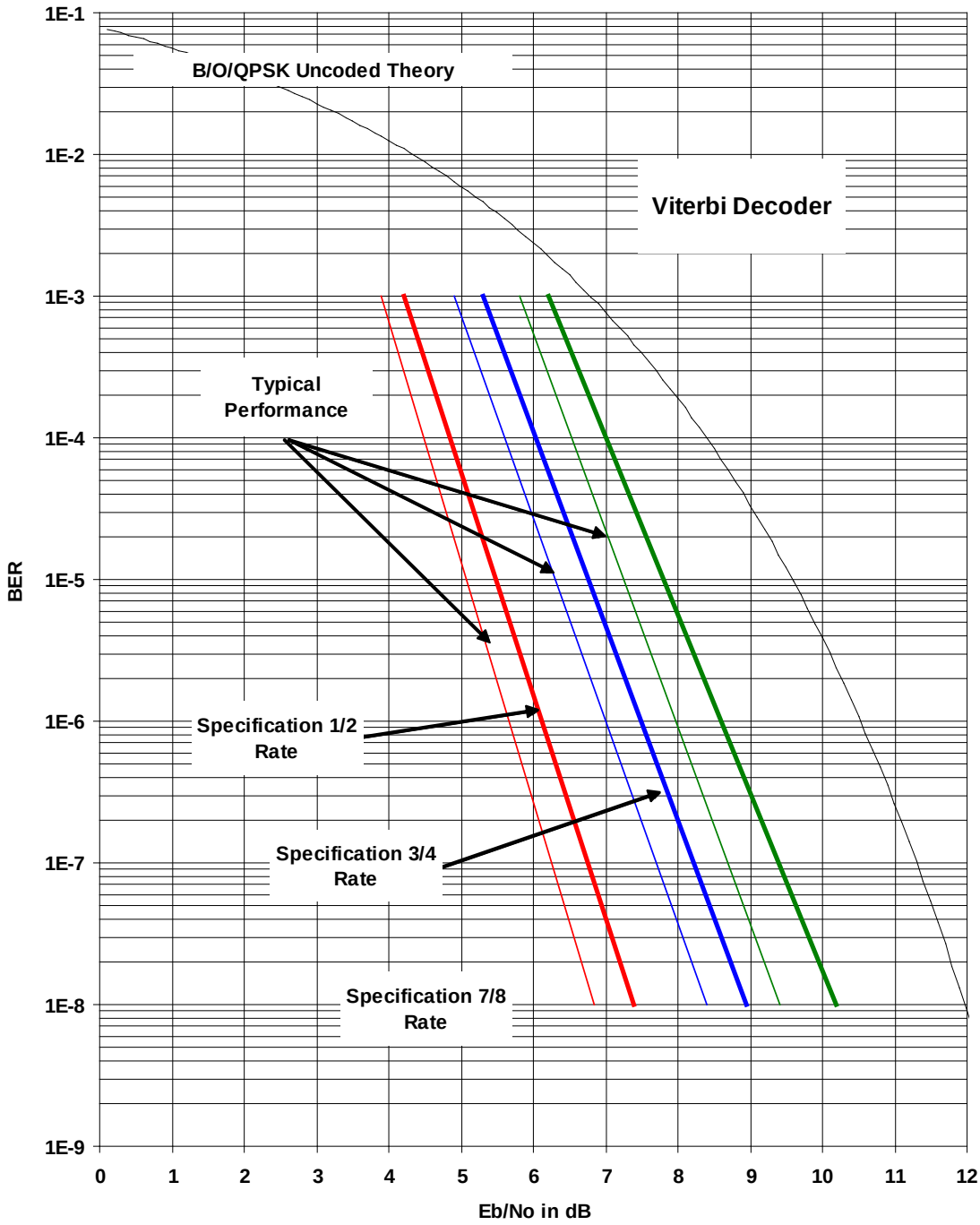


Figure 7-1 – DMD50 B/O/QPSK BER Performance (Viterbi)

Note: Eb/No values include the effect of using Differential Decoding and V.35 descrambling.

7.22.2 BER Performance (Sequential)

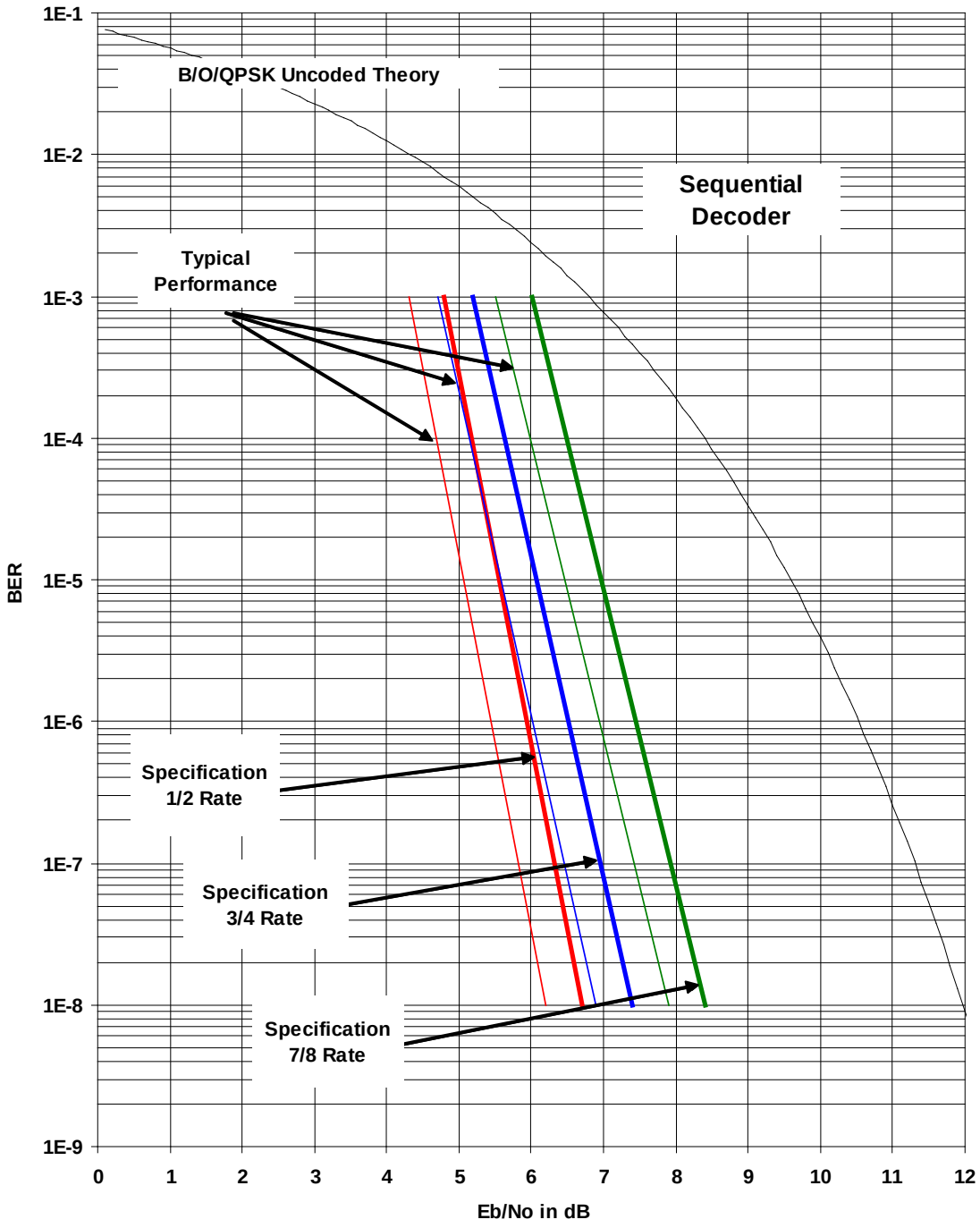


Figure 7-2 – DMD50 B/O/QPSK BER Performance (Sequential)

Note: Eb/No values include the effect of using Differential Decoding and V.35 descrambling.

7.22.3 BER Performance (Viterbi with Reed-Solomon)

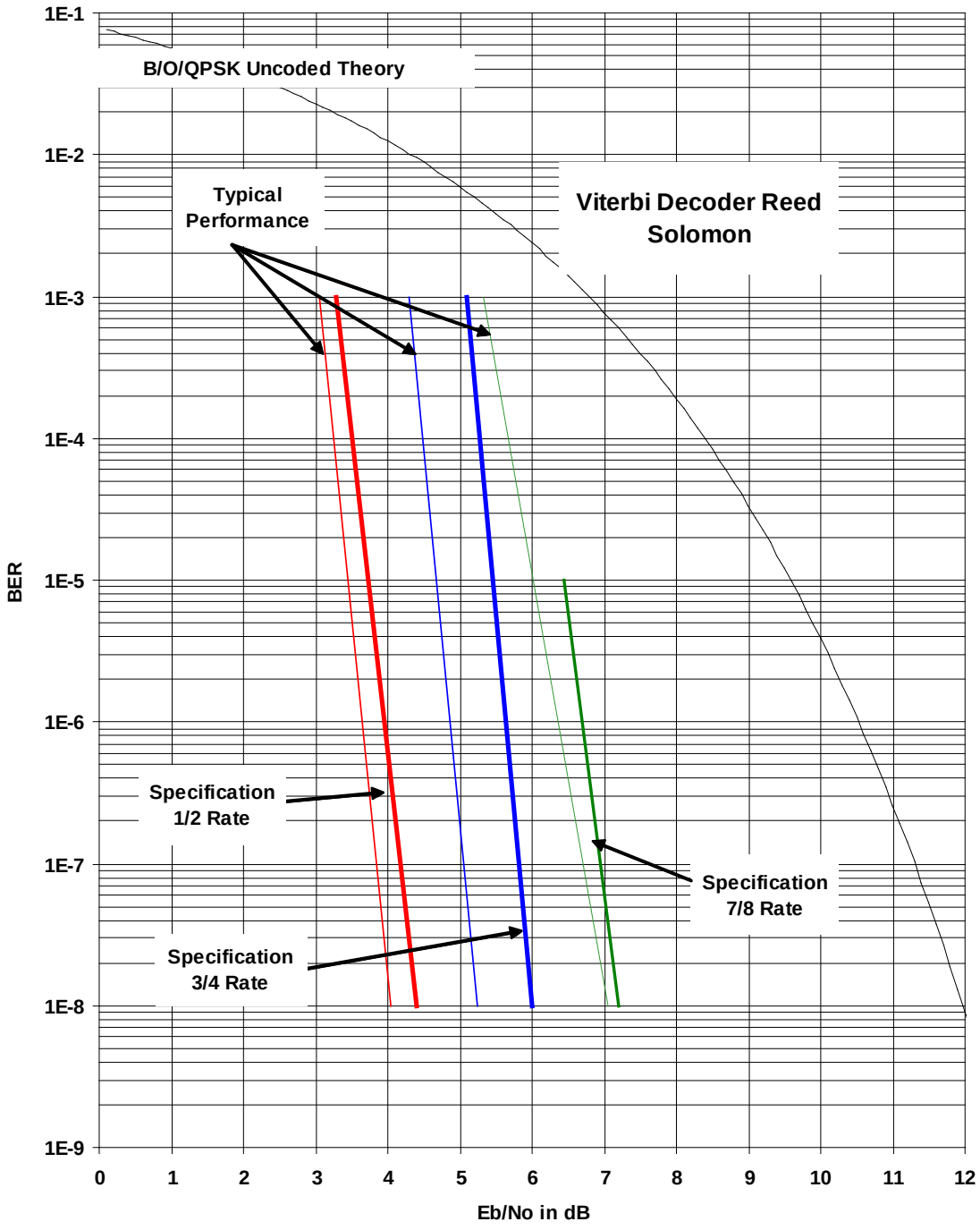


Figure 7-3 – DMD50 B/O/QPSK BER Performance (Viterbi – w/RS)

Note: Eb/No values include the effect of using Differential Decoding.

7.22.4 BER Performance (Turbo)

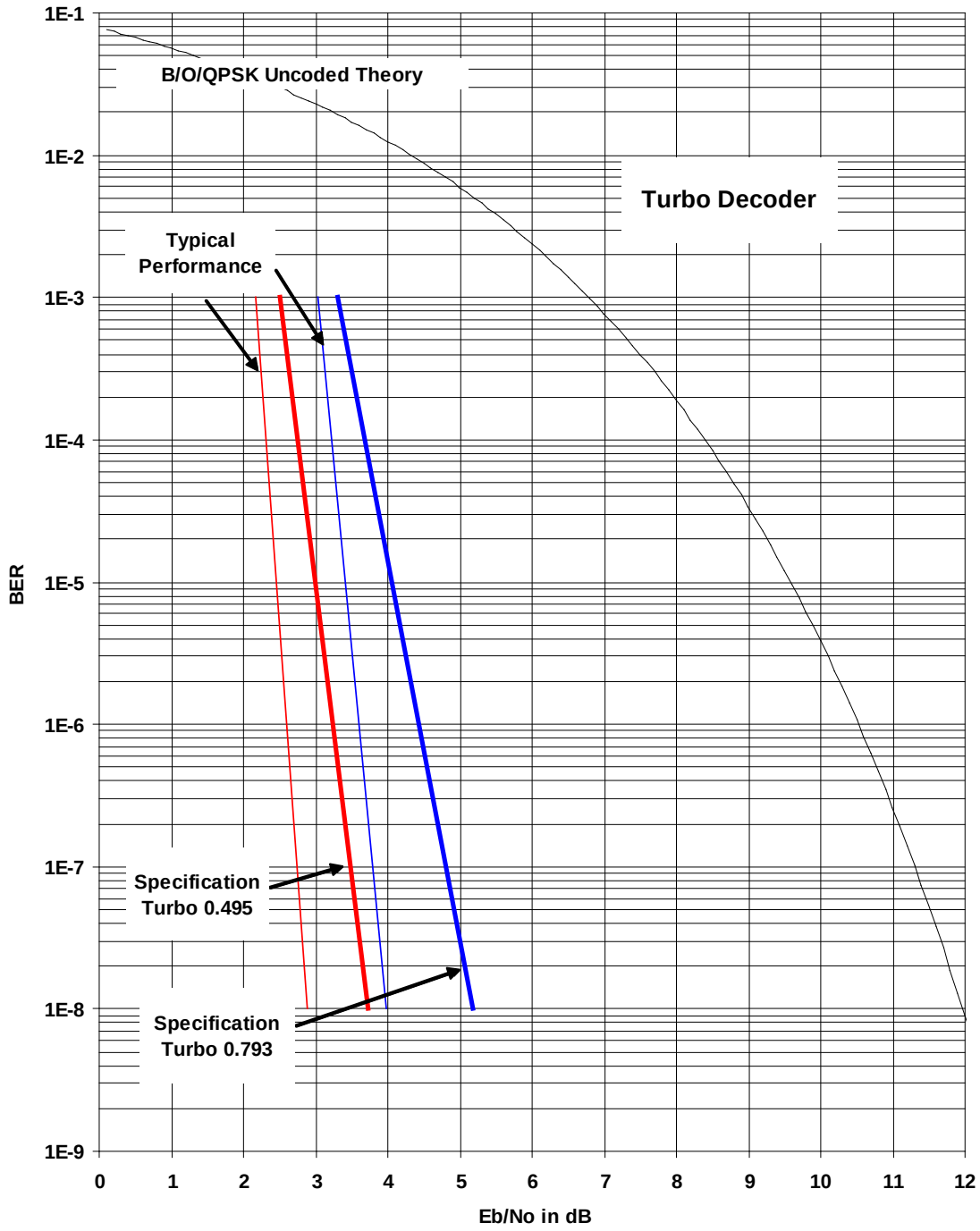


Figure 7-4 – DMD50 B/O/QPSK BER Performance (Turbo)

Note: Eb/No values include the effect of using interleaving and maximum iterations.

7.22.5 BER Performance (8PSK Trellis)

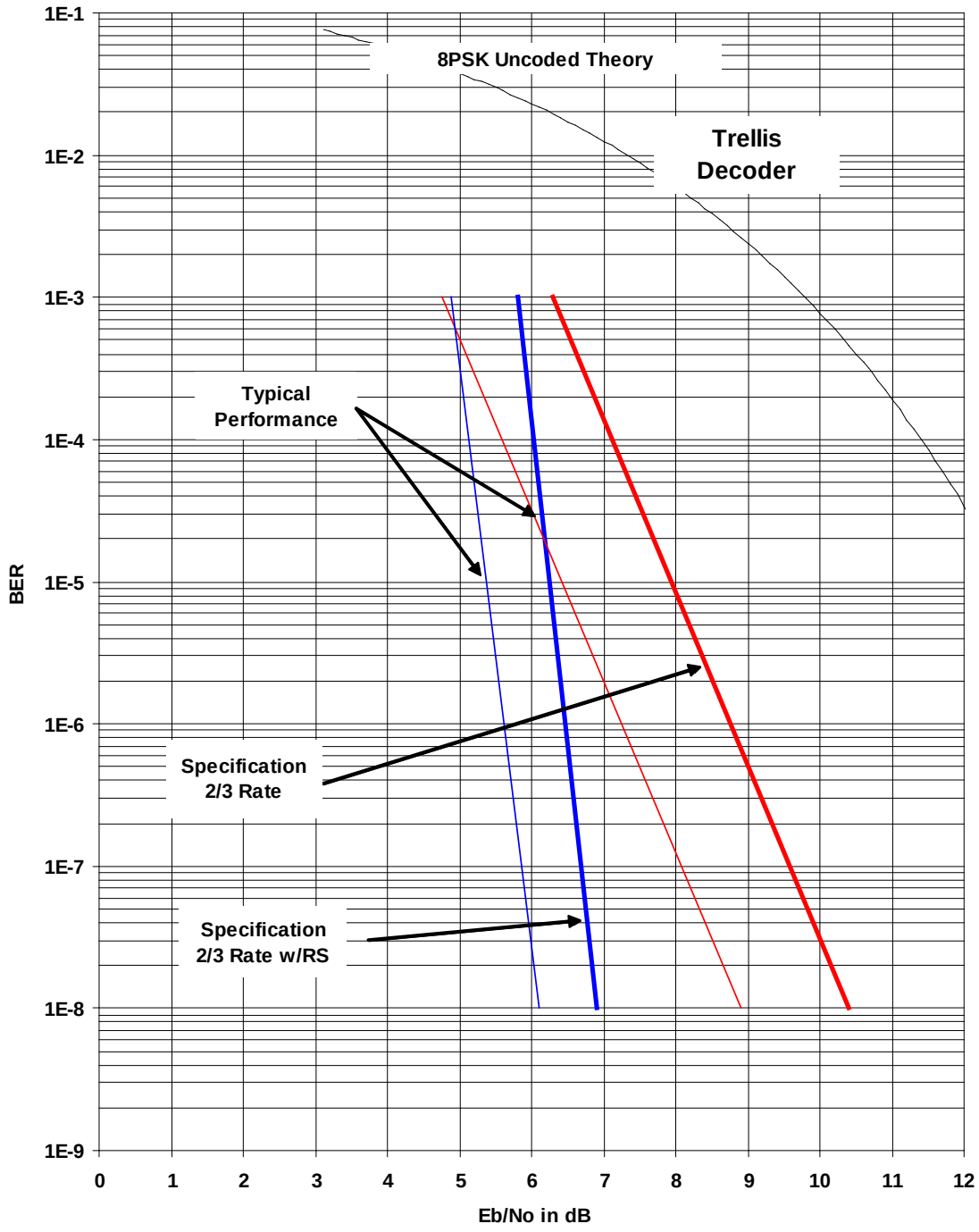


Figure 7-5 – DMD50 8PSK BER Performance (Trellis)

Note: Eb/No values include the effect of using Differential Decoding and V.35 Descrambling.

7.22.6 BER Performance (8PSK Turbo)

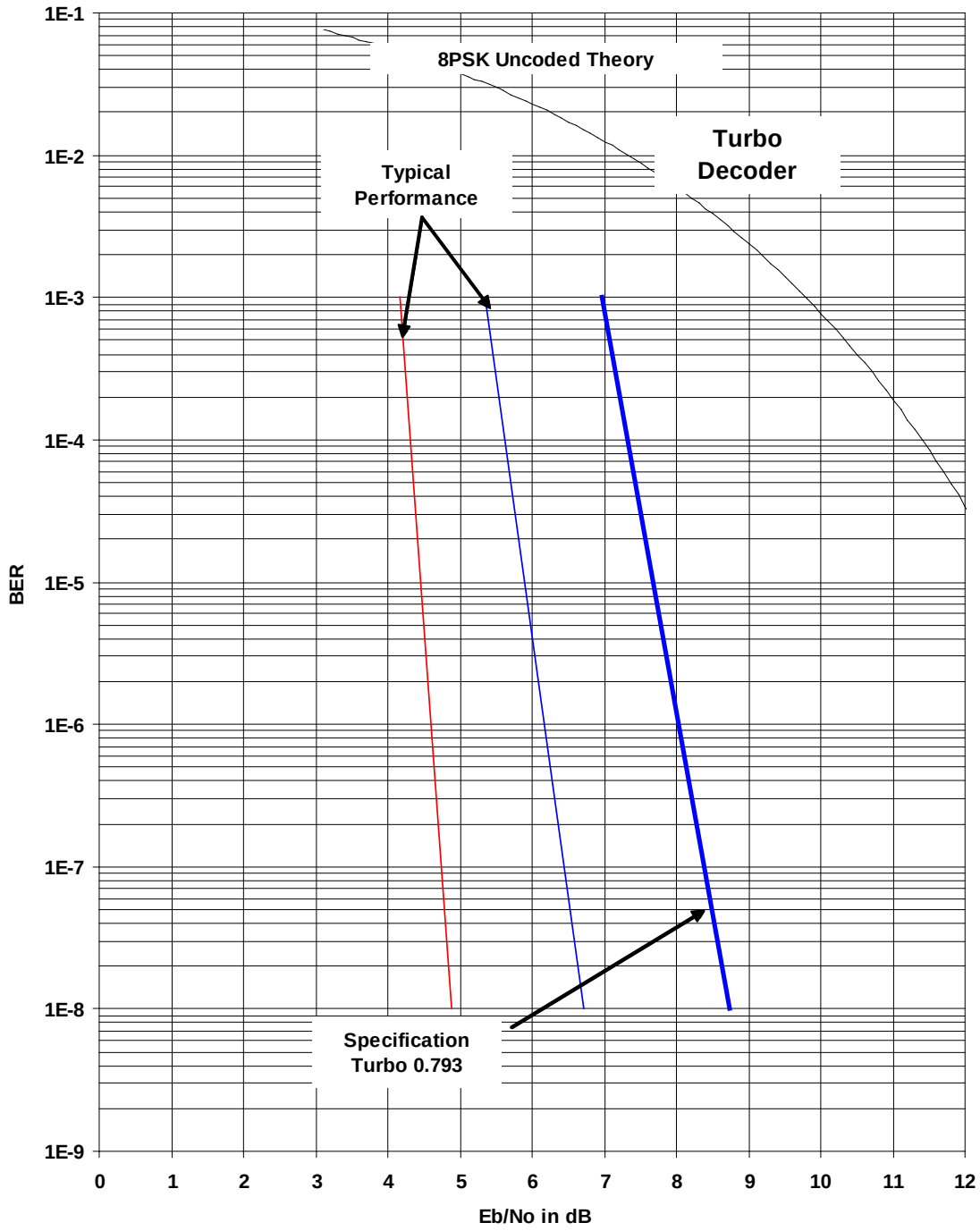


Figure 7-6 – DMD50 8PSK BER Performance (Turbo)

Note: Eb/No values include the effect of using interleaving and maximum iterations.

7.22.7 BER Performance (16QAM Viterbi)

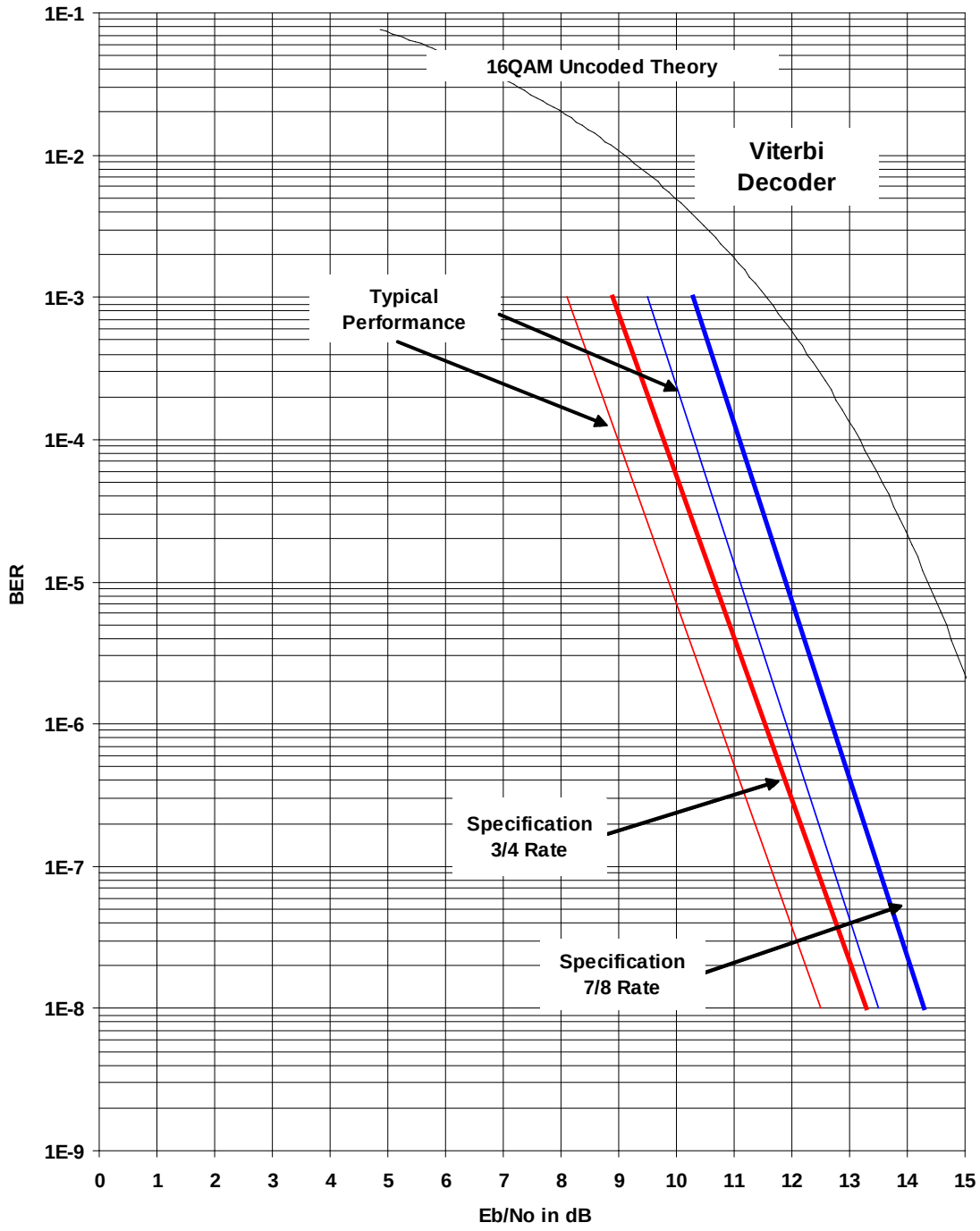


Figure 7-7 – DMD50 16QAM BER Performance (Viterbi)

Note: Eb/No values include the effect of using Differential Decoding and V.35 Descrambling.

7.22.8 BER Performance (16QAM Viterbi with Reed-Solomon)

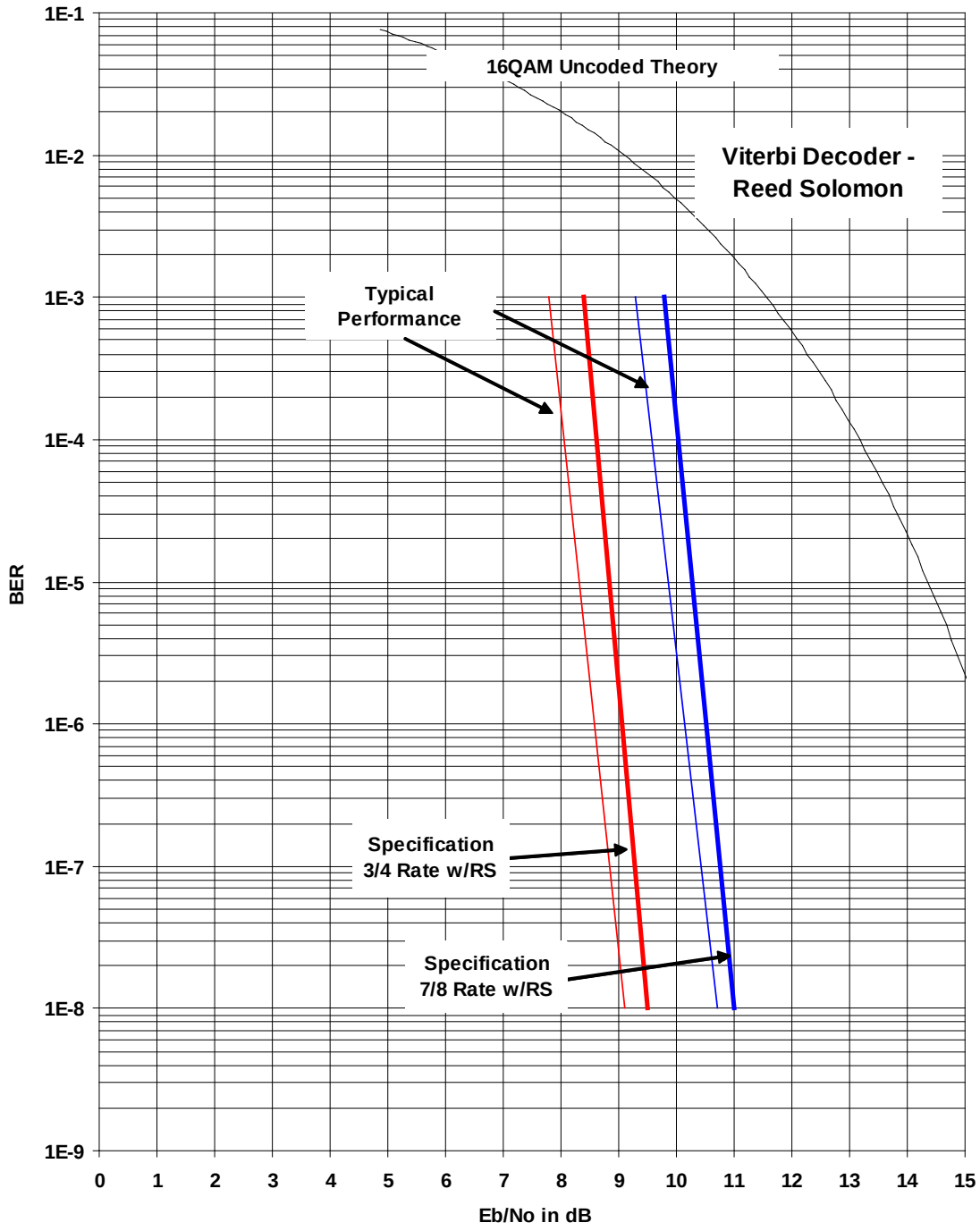


Figure 7-8 – DMD50 16QAM BER Performance (Viterbi w/RS)

Note: Eb/No values include the effect of using Differential Decoding.

7.22.9 BER Performance (16QAM Turbo)

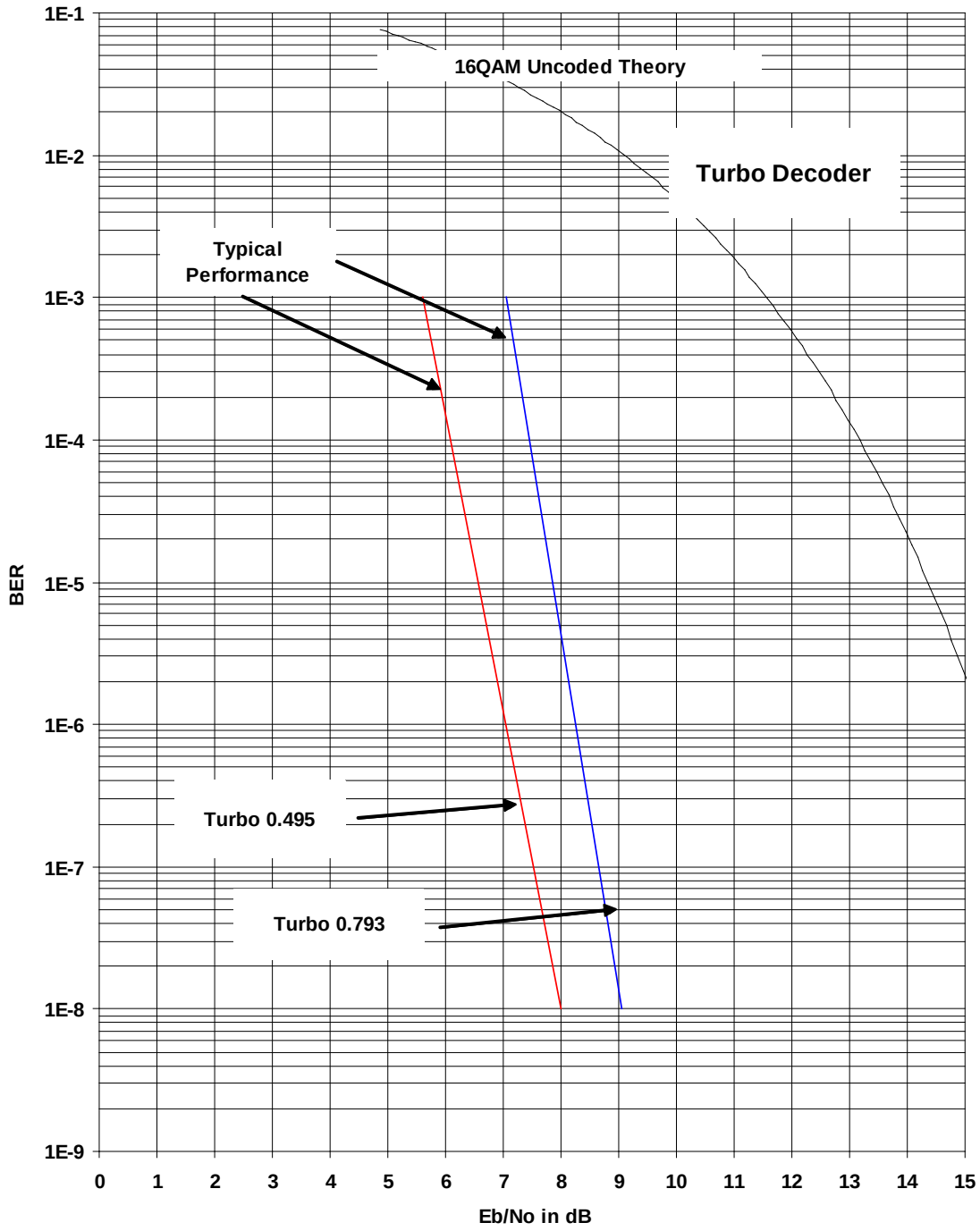


Figure 7-9 – DMD50 16QAM BER Performance (Turbo)

Note: Eb/No values include the effect of using interleaving and maximum iterations.

7.22.10 BER Performance ((O)QPSK Turbo)

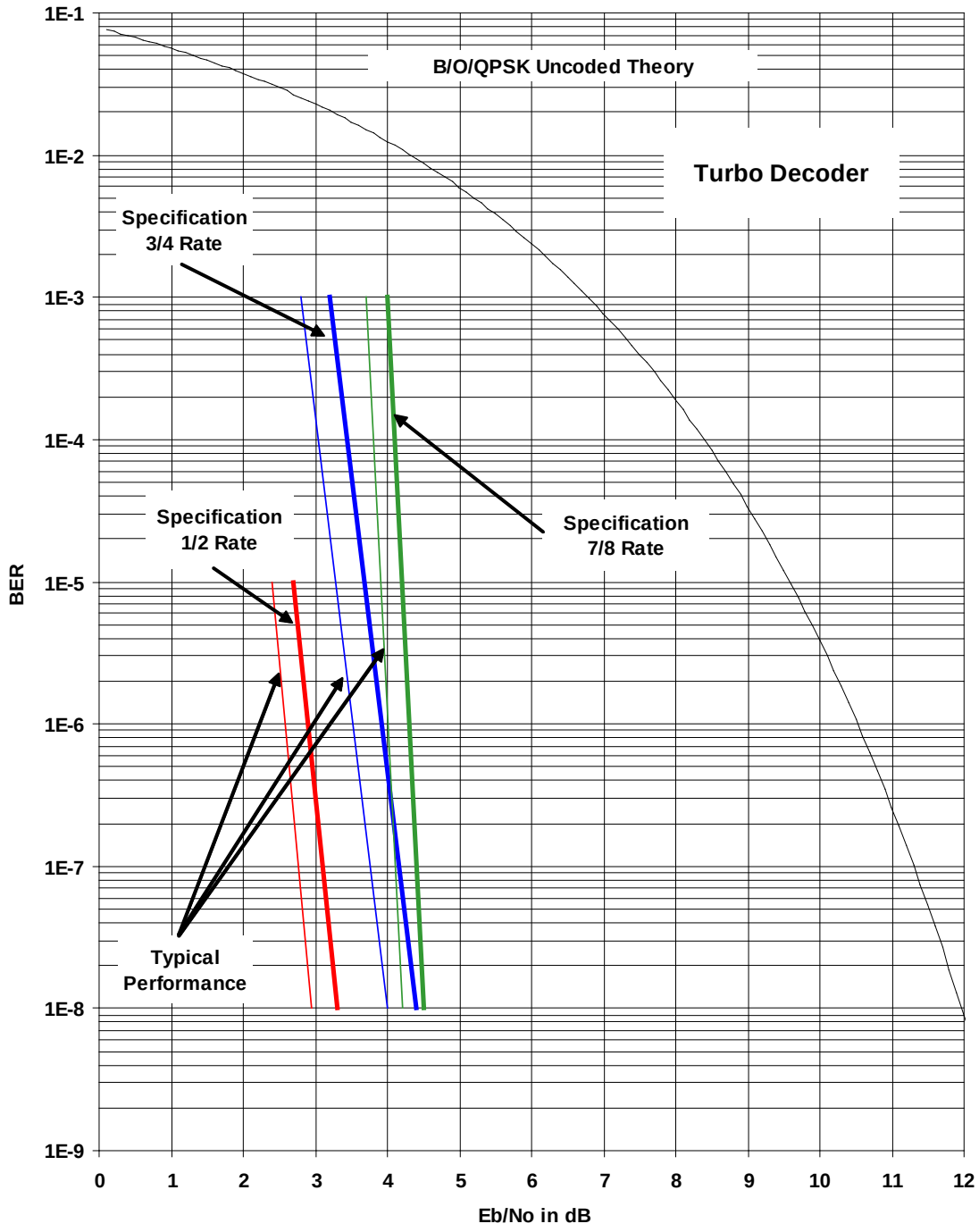


Figure 7-10 – DMD50 (O)QPSK BER Performance (Turbo)

7.22.11 BER Performance (8PSK Turbo)

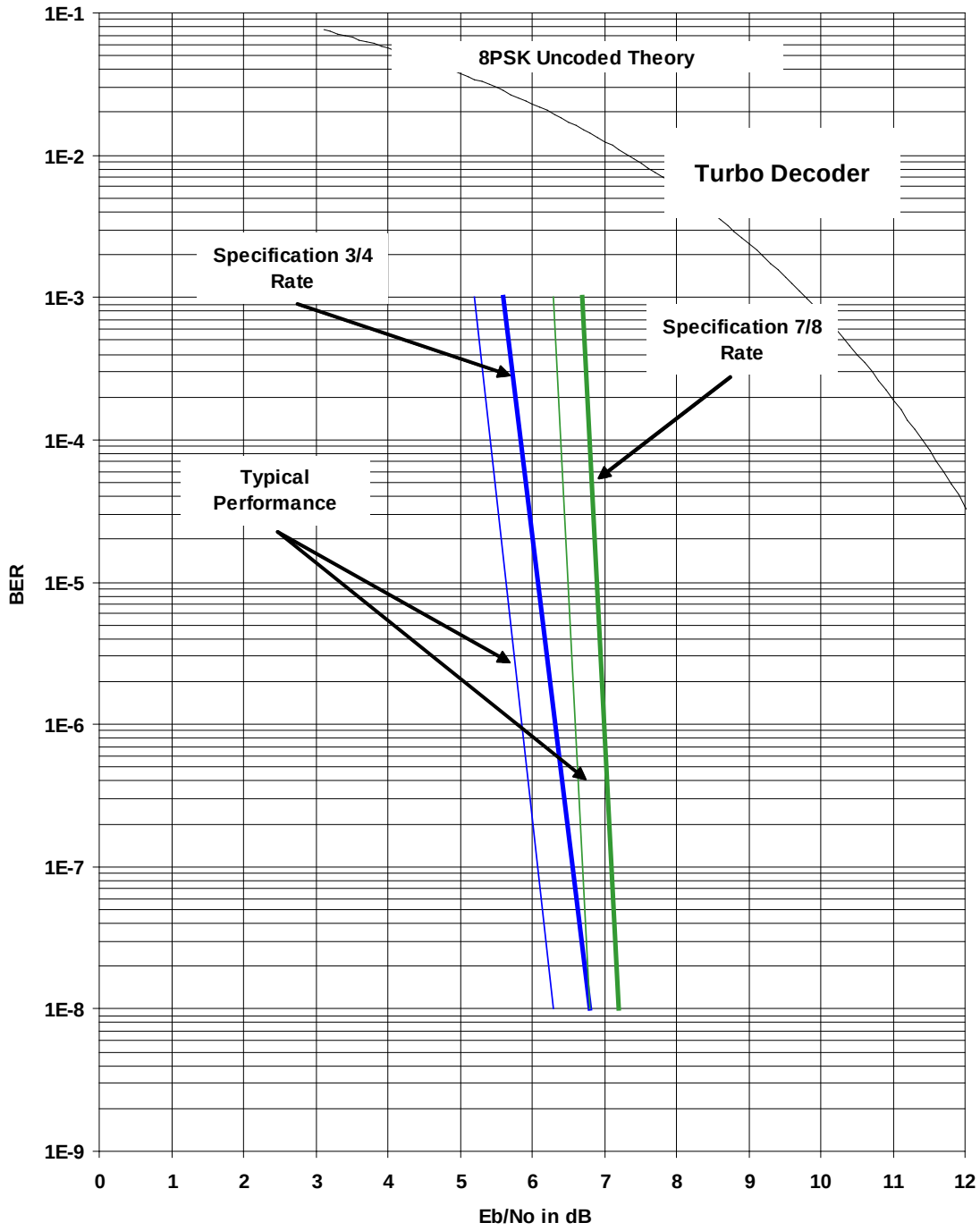


Figure 7-11 – DMD50 8PSK BER Performance (Turbo)

7.22.12 BER Performance (16QAM Turbo)

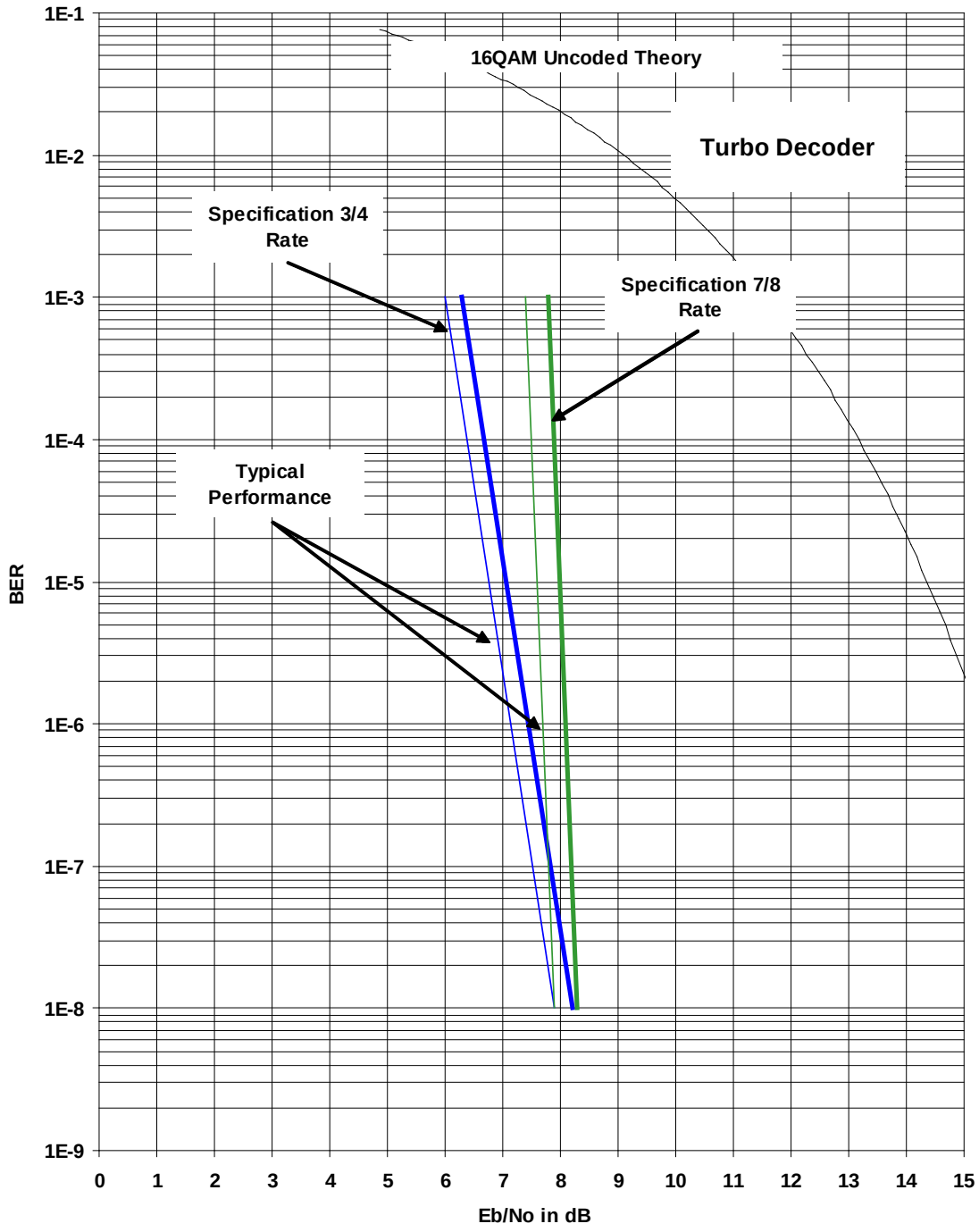


Figure 7-12 – DMD50 16QAM BER Performance (Turbo)

7.22.13 1/2 Rate B/O/QPSK BER Performance (LDPC)

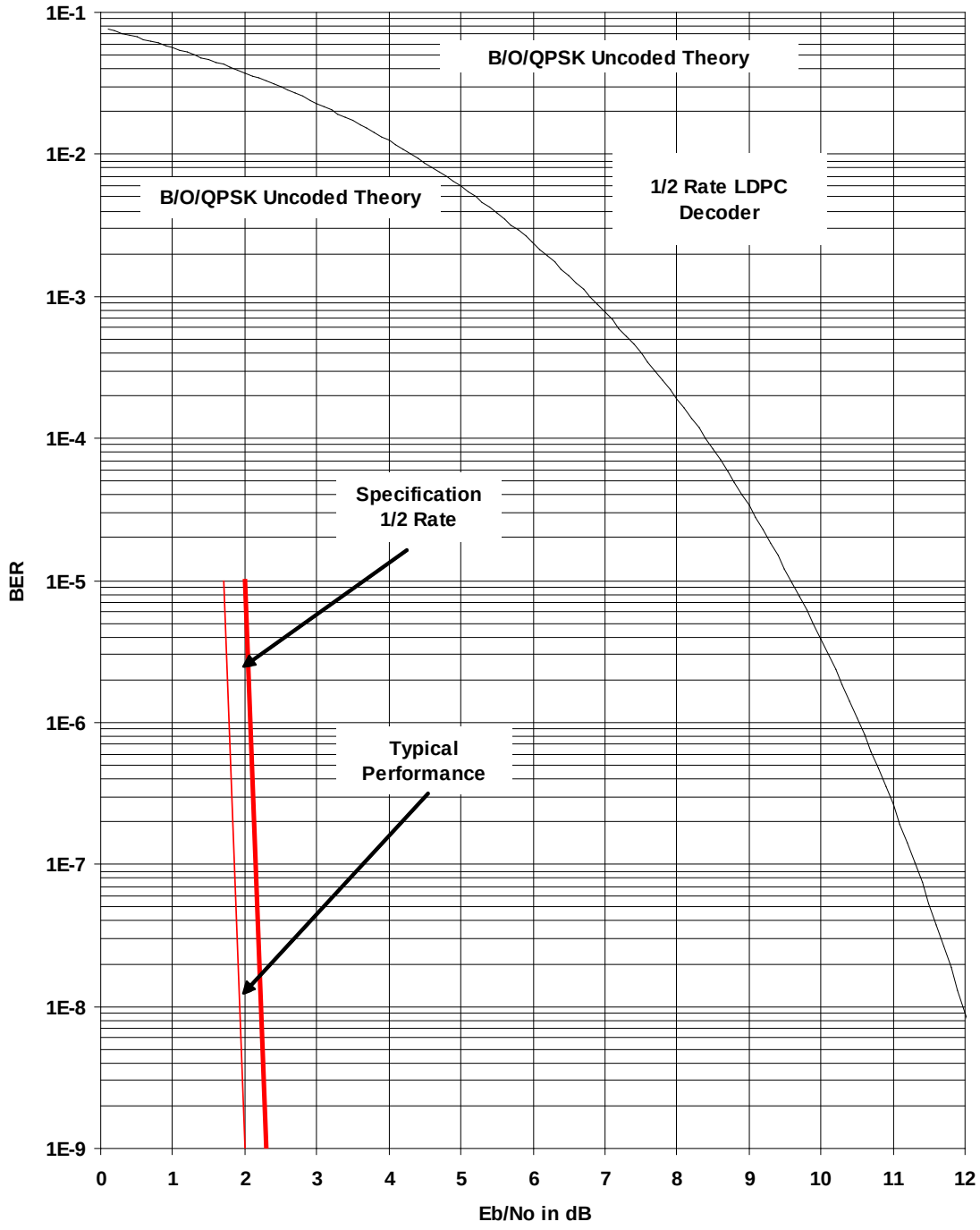


Figure 7-13 – DMD50 Rate 1/2 B/O/QPSK BER Performance (LDPC)

7.22.14 2/3 Rate Q/8PSK/8QAM BER Performance (LDPC)

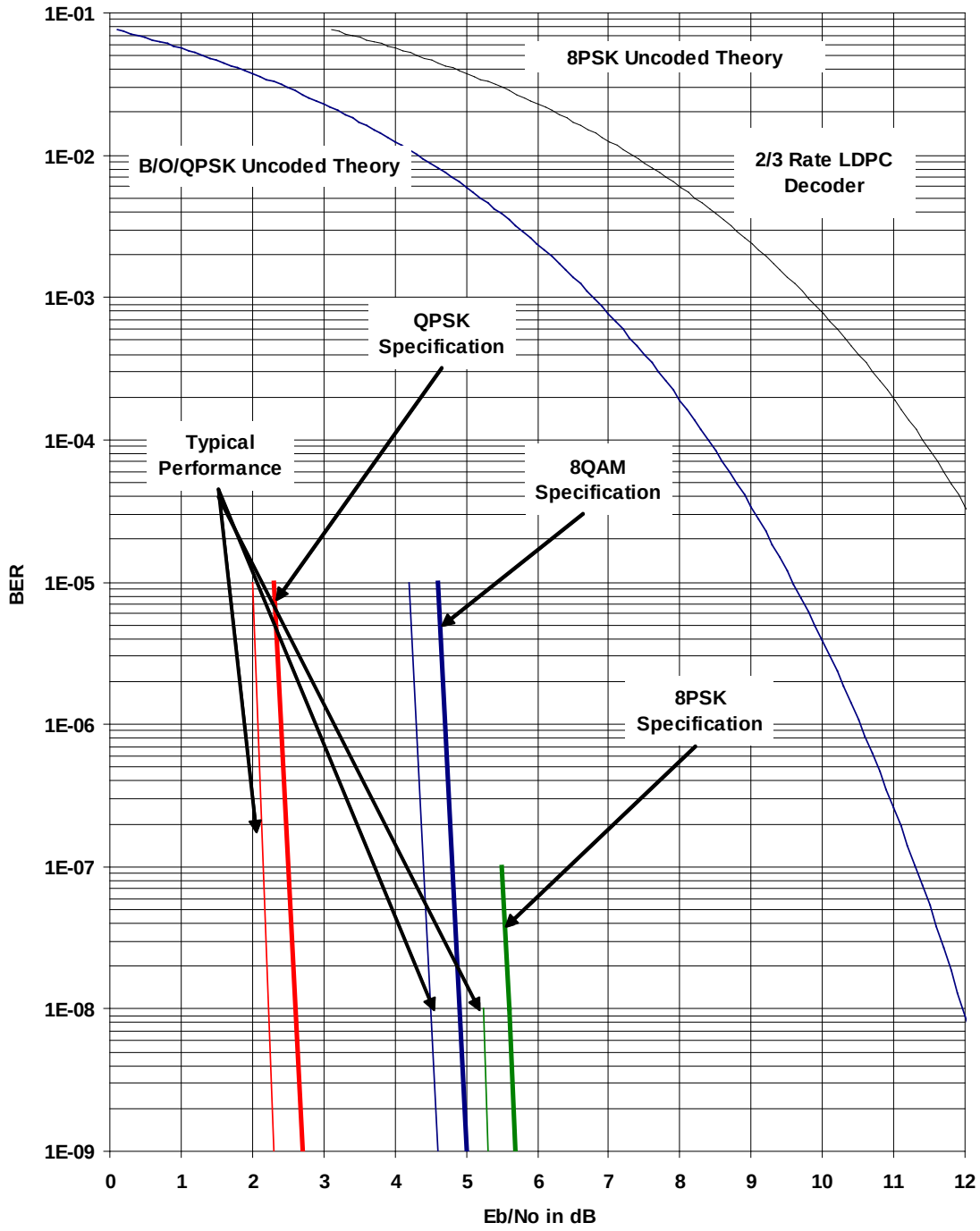


Figure 7-14 – DMD50 Rate 2/3 Q/8PSK/8QAM BER Performance (LDPC)

7.22.15 3/4 Rate Q/8PSK, 8/16QAM BER Performance (LDPC)

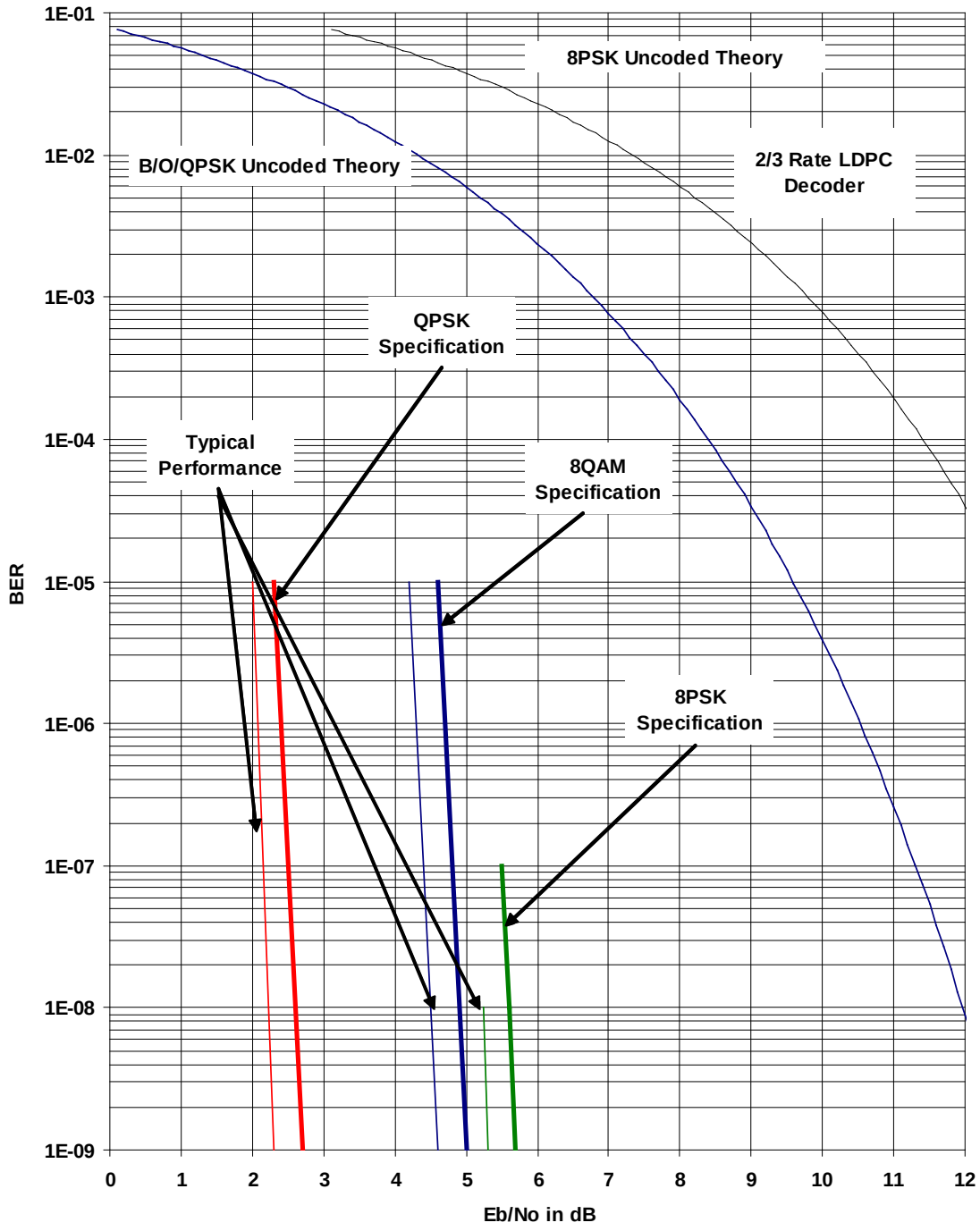


Figure 7-15 – DMD50 Rate 2/3 Q/8PSK/8QAM BER Performance (LDPC)

Table 7-1 - B/O/QPSK BER Performance (Viterbi)						
BER	Specification			Typical		
	1/2 Rate	3/4 Rate	7/8 Rate	1/2 Rate	3/4 Rate	7/8 Rate
1E-3	4.2 dB	5.3 dB	6.2 dB	3.9 dB	4.9 dB	5.8 dB
1E-4	4.8 dB	6.1 dB	7.1 dB	4.5 dB	5.6 dB	6.5 dB
1E-5	5.5 dB	6.8 dB	7.9 dB	5.1 dB	6.3 dB	7.2 dB
1E-6	6.1 dB	7.6 dB	8.6 dB	5.7 dB	7 dB	7.9 dB
1E-7	6.7 dB	8.3 dB	9.3 dB	6.2 dB	7.7 dB	8.6 dB
1E-8	7.4 dB	8.9 dB	10.2 dB	6.8 dB	8.4 dB	9.4 dB
1E-9	8.2 dB	9.7 dB	11 dB	7.4 dB	9.1 dB	10.0 dB
1E-10	9 dB	10.3 dB	11.7 dB	8.1 dB	9.8 dB	10.5 dB

Table 7-2 - B/O/QPSK BER Performance (Sequential)						
BER	Specification			Typical		
	1/2 Rate	3/4 Rate	7/8 Rate	1/2 Rate	3/4 Rate	7/8 Rate
1E-3	4.8 dB	5.2 dB	6 dB	4.3 dB	4.7 dB	5.5 dB
1E-4	5.2 dB	5.7 dB	6.4 dB	4.7 dB	5.2 dB	5.9 dB
1E-5	5.6 dB	6.1 dB	6.9 dB	5.1 dB	5.6 dB	6.4 dB
1E-6	5.9 dB	6.5 dB	7.4 dB	5.4 dB	6.1 dB	6.9 dB
1E-7	6.3 dB	7 dB	7.9 dB	5.8 dB	6.5 dB	7.4 dB
1E-8	6.7 dB	7.4 dB	8.4 dB	6.2 dB	6.9 dB	7.9 dB
1E-9	7.1 dB	7.8 dB	8.9 dB	6.6 dB	7.4 dB	8.4 dB
1E-10	7.4 dB	8.3 dB	9.4 dB	6.9 dB	7.8 dB	8.9 dB

Table 7-3 - B/O/QPSK BER Performance (Viterbi - w/RS)						
BER	Specification			Typical		
	1/2 Rate	3/4 Rate	7/8 Rate	1/2 Rate	3/4 Rate	7/8 Rate
1E-3	3.3 dB	5.1 dB	-	3 dB	4.3 dB	5.3 dB
1E-4	3.5 dB	5.3 dB	-	3.2 dB	4.5 dB	5.7 dB
1E-5	3.8 dB	5.4 dB	6.5 dB	3.4 dB	4.7 dB	6 dB
1E-6	4.1 dB	5.6 dB	6.7 dB	3.6 dB	4.9 dB	6.4 dB
1E-7	4.2 dB	5.8 dB	6.9 dB	3.8 dB	5.1 dB	6.7 dB
1E-8	4.4 dB	6 dB	7.2 dB	4 dB	5.3 dB	7.1 dB
1E-9	4.7 dB	6.1 dB	7.5 dB	4.2 dB	5.4 dB	7.4 dB
1E-10	5 dB	6.3 dB	7.8 dB	4.4 dB	5.6 dB	7.7 dB

Table 7-4 - B/O/QPSK BER Performance (Turbo)				
BER	Specification		Typical	
	Turbo 0.495	Turbo 0.793	Turbo 0.495	Turbo 0.793
1E-3	2.5 dB	3.3 dB	2.2 dB	3 dB
1E-4	2.7 dB	3.7 dB	2.3 dB	3.2 dB
1E-5	3 dB	4.1 dB	2.5 dB	3.4 dB
1E-6	3.2 dB	4.4 dB	2.6 dB	3.6 dB
1E-7	3.5 dB	4.8 dB	2.7 dB	3.8 dB
1E-8	3.7 dB	5.2 dB	2.9 dB	4 dB
1E-9	4 dB	5.6 dB	3 dB	4.2 dB
1E-10	4.2 dB	5.9 dB	3.2 dB	4.4 dB

Table 7-5 - 8PSK BER Performance (Trellis)				
BER	Specification		Typical	
	2/3 Rate	2/3 Rate w/RS	2/3 Rate	2/3 Rate w/RS
1E-3	6.3 dB	5.8 dB	4.8 dB	4.9 dB
1E-4	7.3 dB	6.1 dB	5.6 dB	5.1 dB
1E-5	8.2 dB	6.3 dB	6.4 dB	5.4 dB
1E-6	9 dB	6.5 dB	7.2 dB	5.6 dB
1E-7	9.8 dB	6.7 dB	8.1 dB	5.8 dB
1E-8	10.4 dB	6.9 dB	8.9 dB	6.1 dB
1E-9	11.1 dB	7.1 dB	9.7 dB	6.3 dB
1E-10	11.9 dB	7.3 dB	10.5 dB	6.6 dB

Table 7-6 - 8PSK BER Performance (Turbo)				
BER	Specification		Typical	
	Turbo 0.495	Turbo 0.793	Turbo 0.495	Turbo 0.793
1E-3	-	7 dB	4.2 dB	5.4 dB
1E-4	-	7.3 dB	4.3 dB	5.6 dB
1E-5	-	7.7 dB	4.5 dB	5.9 dB
1E-6	-	8 dB	4.6 dB	6.2 dB
1E-7	-	8.4 dB	4.7 dB	6.4 dB
1E-8	-	8.7 dB	4.9 dB	6.7 dB
1E-9	-	9.1 dB	5 dB	7 dB
1E-10	-	9.5 dB	5.2 dB	7.3 dB

Table 7-7 - 16QAM BER Performance (Viterbi)				
BER	Specification		Typical	
	3/4 Rate	7/8 Rate	3/4 Rate	7/8 Rate
1E-3	8.9 dB	10.3 dB	8.1 dB	9.5 dB
1E-4	9.8 dB	11.1 dB	9 dB	10.3 dB
1E-5	10.7 dB	11.9 dB	9.9 dB	11.1 dB
1E-6	11.5 dB	12.7 dB	10.7 dB	11.9 dB
1E-7	12.4 dB	13.5 dB	11.6 dB	12.7 dB
1E-8	13.3 dB	14.3 dB	12.5 dB	13.5 dB
1E-9	14.2 dB	15.1 dB	13.4 dB	14.3 dB
1E-10	15 dB	15.9 dB	14.2 dB	15.1 dB

Table 7-8 - 16QAM BER Performance (Viterbi w/RS)				
BER	Specification		Typical	
	3/4 Rate	7/8 Rate	3/4 Rate	7/8 Rate
1E-3	8.4 dB	9.8 dB	7.8 dB	9.3 dB
1E-4	8.6 dB	10.1 dB	8.1 dB	9.6 dB
1E-5	8.9 dB	10.3 dB	8.3 dB	9.9 dB
1E-6	9.1 dB	10.5 dB	8.6 dB	10.2 dB
1E-7	9.3 dB	10.8 dB	8.8 dB	10.4 dB
1E-8	9.5 dB	11.0 dB	9.1 dB	10.7 dB
1E-9	9.8 dB	11.3 dB	9.3 dB	11.0 dB
1E-10	10.0 dB	11.5 dB	9.6 dB	11.3 dB

Table 7-9 - 16QAM BER Performance (Turbo)				
BER	Specification		Typical	
	Turbo 0.495	Turbo 0.793	Turbo 0.495	Turbo 0.793
1E-3	-	-	5.6 dB	7 dB
1E-4	-	-	6.1 dB	7.4 dB
1E-5	-	-	6.6 dB	7.8 dB
1E-6	-	-	7 dB	8.2 dB
1E-7	-	-	7.5 dB	8.6 dB
1E-8	-	-	8 dB	9 dB
1E-9	-	-	8.5 dB	9.4 dB
1E-10	-	-	9 dB	9.9 dB

Table 7-10 - (O)QPSK BER Performance (Turbo)						
BER	Specification			Typical		
	1/2 Rate	3/4 Rate	7/8 Rate	1/2 Rate	3/4 Rate	7/8 Rate
1E-3	-	3.2 dB	4 dB	-	2.8 dB	3.7 dB
1E-4	-	3.4 dB	4.1 dB	-	3 dB	3.8 dB
1E-5	2.7 dB	3.6 dB	4.2 dB	2.4 dB	3.2 dB	3.9 dB
1E-6	2.9 dB	3.8 dB	4.3 dB	2.6 dB	3.4 dB	4 dB
1E-7	3.1 dB	4.1 dB	4.4 dB	2.8 dB	3.7 dB	4.1 dB
1E-8	3.3 dB	4.4 dB	4.5 dB	3 dB	4 dB	4.2 dB

Table 7-11 - 8PSK BER Performance (Turbo)				
BER	Specification		Typical	
	3/4 Rate	7/8 Rate	3/4 Rate	7/8 Rate
1E-3	5.6 dB	6.7 dB	5.2 dB	6.3 dB
1E-4	5.8 dB	6.8 dB	5.4 dB	6.4 dB
1E-5	6 dB	6.9 dB	5.6 dB	6.5 dB
1E-6	6.3 dB	7 dB	5.8 dB	6.6 dB
1E-7	6.5 dB	7.1 dB	6.0 dB	6.7 dB
1E-8	6.7 dB	7.2 dB	6.3 dB	6.8 dB

Table 7-12 - 16 QAM BER Performance (Turbo)				
BER	Specification		Typical	
	3/4 Rate	7/8 Rate	3/4 Rate	7/8 Rate
1E-3	6.3 dB	7.8 dB	6 dB	7.4 dB
1E-4	6.7 dB	7.9 dB	6.4 dB	7.5 dB
1E-5	7 dB	8 dB	6.7 dB	7.6 dB
1E-6	7.4 dB	8.1 dB	7.1 dB	7.7 dB
1E-7	7.8 dB	8.2 dB	7.5 dB	7.8 dB
1E-8	8.2 dB	8.3 dB	7.9 dB	7.9 dB

Table 7-13 - B/O/QPSK BER Performance (LDPC)						
BER	Specification			Typical		
	1/2 Rate	2/3 Rate	3/4 Rate	1/2 Rate	2/3 Rate	3/4 Rate
1E-5	2 dB	2.3 dB	3 dB	1.7 dB	2 dB	2.6 dB
1E-9	2.3 dB	2.7 dB	3.3 dB	2 dB	2.3 dB	3 dB

Table 7-13a – BPSK BER Performance (LDPC)		
BER	Specification	Typical
	1/2 Rate	1/2 Rate
1E-5	2 dB	1.7 dB
1E-9	2.3 dB	2 dB

Table 7-14 - 8PSK / 8-QAM Rate BER Performance (LDPC)								
BER	8PSK				8-QAM			
	Specification		Typical		Specification		Typical	
	2/3 Rate	3/4 Rate	2/3 Rate	3/4 Rate	2/3 Rate	3/4 Rate	2/3 Rate	3/4 Rate
1E-5	-	5.6 dB	-	5.2 dB	4.6 dB	5.6 dB	4.2 dB	5.2 dB
1E-9	5.7 dB	6 dB	5.3 dB	5.6 dB	5 dB	6 dB	4.6 dB	5.6 dB

Table 7-15 - 16QAM BER Performance (LDPC)		
BER	Specification	Typical
	3/4 Rate	3/4 Rate
1E-5	6.8 dB	6.2 dB
1E-9	7.1 dB	6.8 dB

Table 7-16. Open Network Performance				
BER	Specification		Typical	
	IBS	IDR	IBS	IDR
	1/2 Rate	3/4 Rate	3/4 Rate	3/4 Rate
1E-3	4.1 dB	5.2 dB	4.2 dB	4.35 dB
1E-4	4.6 dB	6.0 dB	4.9 dB	5.25 dB
1E-5	5.3 dB	6.7 dB	5.6 dB	5.9 dB
1E-6	6.0 dB	7.5 dB	6.3 dB	6.6 dB
1E-7	6.6 dB	8.2 dB	6.9 dB	7.3 dB
1E-8	7.1 dB	8.7 dB	7.5 dB	7.8 dB

7.22.16 ACG Output Voltage

The AGC Output Voltage is a function of the Input Power Level in dBm. The AGC Output Voltage is found on the Alarm connector Pin 14 of J15.

Figure 7-13. AGC Voltage Monitor

Appendix A. Product Options

A.1 Hardware Options

The following enhanced interface cards are available.

A.2 G.703/IDR ESC Interface

The modem can be equipped with either a G.703 T1/E1/T2/E2 /IDR ESC Interface or G.703 T1/E1/T2/E2/T3/E3/STS1IDR ESC.

A.3 Internal High Stability

The modem can be equipped with a $5x10^{-8}$ or better Stability Frequency Reference as an add-on enhancement. This is a factory upgrade only.

A.4 DC Input Prime Power

Allows for an optional DC Input Power Source **(standard unit only).**

A.5 ASI/RS-422 Parallel

ASI, Serial, BNC (Female)
DVB/M2P, Parallel, RS-422, DB-25 (Female)

A.6 ASI/LVDS Parallel

ASI, Serial, BNC (Female)
DVB/M2P, Parallel, LVDS, DB-25 (Female)

A.7 HSSI

High-Speed Serial Interface 50-Pin SCSI-2 Type Connector. Complies with Cisco Systems in HSSI Design Specification, Revision 3.0.

A.8 Ethernet Data Interface

Four RJ-45, Auto-Crossover, Auto-Sensing, 10/100 Ethernet Data Ports. Complies with IEEE 802.3 and IEEE 802.3u.

A.9 HSSI / G.703

High-Speed Serial Interface 50-Pin SCSI-2 Type Connector. Complies with Cisco Systems in HSSI Design Specification, Revision 3.0. The G.703 interface supports T1, E1, T2, E2 rates balanced or unbalanced. It does not support backward alarms.

A.10 HSSI / ETHERNET

High-Speed Serial Interface 50-Pin SCSI-2 Type Connector. Complies with Cisco Systems in HSSI Design Specification, Revision 3.0. Four RJ-45, Auto-Crossover, Auto-Sensing, 10/100 Ethernet Data Ports. Complies with IEEE 802.3 and IEEE 802.3u.

A.11 Turbo Product Code / Variable Reed-Soloman

The modem can be equipped with an optional TPC Codec Card. This card allows variable Reed-Solomon rates as well as Turbo Codec and Sequential Codec Outer Code. This option must be installed at the factory and may require other options.

A.12 Customized Options

The modem may be customized for specific customer requirements. Most modifications or customization can be accomplished by means of firmware/software modifications.
The following are examples of the types of customization available to the user:

- Customized Data Rates.
- Customized Scrambler/Descramblers.
- Customized Overhead Framing Structures.
- Customized Modulation Formats.
- Customized Uses for the ES-ES Overhead Channel.

Contact the CEFD Customer Service or Sales Department at (480) 333-4357 for all requests.

Appendix B. Front Panel Upgrade Procedure

B.1 Introduction

The Universal Satellite Modem offers the ability to perform field upgrades of the modem's feature set quickly and easily from the front panel. Purchased upgrades will become part of the modems permanent configuration. Demonstration upgrades will enable the optional features for a 30-day evaluation period.

B.2 Required Equipment

The Universal Satellite Modem is the only equipment required for this procedure.

B.3 Upgrade Procedure

The following paragraphs describe the procedure for permanently updating the feature set of the Universal Satellite Modem

1. The following steps allow users to quickly determine from the front panel whether or not the desired feature(s) are supported by the hardware currently installed in the modem.

    a. From the modem's Main Menu, scroll right to the SYSTEM Menu.
    b. Scroll down.
    c. Scroll right to the HW/FW CONFIG Menu.
    d. Scroll down
    e. Scroll right to the FEATURES Menu.
    f. Scroll down.
    g. Scroll right to the UPGRADE LIST Menu.
    h. Scroll down.
    i. Scroll right through the available list of options.

The top line identifies the options and the second line identifies the following options status:

INSTALLED indicates that the option is already available as part of the modems feature set.

HW & KEY REQ indicates that additional hardware is required to support the option. Contact your Radyne sales representative for more information regarding the required hardware upgrade.

KEY CODE REQ indicates that the desired option is available as a front panel upgrade.

2. Contact Radyne with the Unit ID and Desired Upgrades. The modem's Unit ID can be found on the front panel as follows:

    a. From the modem's Main Menu, scroll right to the SYSTEM Menu.
    b. Scroll down.
    c. Scroll right to the HW/FW CONFIG Menu.
    d. Scroll down.
    e. Scroll right to the FEATURES Menu.
    f. Scroll down

The value displayed on the top line of this menu is the 12-digit Unit ID. It is displayed as on the front panel of the modem as 3 sets of 4 digits in a dot-delineated format as follows:

1 2 3 4 . 1 2 3 4 . 1 2 3 4

Your Radyne sales representative will ask you for this number along with your desired feature set upgrades when placing your order.

3. Once your order has been processed, you will be issued a 12-digit feature set upgrade code. This code is only good on the modem for which it was ordered. To enter this code from the front panel, perform the following:

    a. From the modem's Main Menu, scroll right to the SYSTEM Menu.
    b. Scroll down.
    c. Scroll right to the HW/FW CONFIG Menu.
    d. Scroll down.
    e. Scroll right to the FEATURES Menu.
    f. Scroll down.

The value displayed on the top line of this menu is the 12-digit Unit ID. It is displayed on the front panel of the modem as 3 sets of 4 digits in a dot-delineated format indicated in Step 2. The second line is the data entry area and is displayed as 3 sets of 4 underscores in a dot-delineated format.

    g. Press <ENTER>. A cursor will begin flashing in the data entry area.
    h. Using the numeric keypad, enter your 12-digit upgrade code.
    i. Press <ENTER>.

If the code entered is correct, the display will display **CODE ACCEPTED**, otherwise the **INVALID CODE** will be displayed**..**

NOTE

Care should be taken to insure that the upgrade code is entered properly. After three unsuccessful attempts to enter a code, the front panel upgrade and demonstration capability will be locked out and it will be necessary to cycle power on the modem in order to continue.

B.4 Demonstration Procedure

The procedure for enabling a 30-day demo of the options is similar to the procedure used for permanently updating the modems feature set. The one big difference being that at the end of 30 days, the demo features will automatically be disabled and the modem will revert back to its permanent configuration.

NOTE

At the end of the demonstration period, when the modem reverts back to its permanent configuration an interrupt in traffic will occur, regardless of whether or not a demo enabled features was being run at the time. In addition, operator intervention may be required to restore the data paths. In order to avoid this interruption in service, the user can cancel the demonstration at any time by following the instructions outlined in the section on "Canceling Demonstration Mode."

1. The following steps allow users to quickly determine from the front panel whether or not the desired feature(s) are supported by the hardware currently installed in the modem.

    a. From the modem's Main Menu, scroll right to the SYSTEM Menu.
    b. Scroll down.
    c. Scroll right to the HW/FW CONFIG Menu.
    d. Scroll down.
    e. Scroll right to the FEATURES Menu.
    f. Scroll down.
    g. Scroll right to the UPGRADE LIST Menu.
    h. Scroll down.
    i. Scroll right through the available list of options.

    The top line identifies the options and the second line identifies the options status.

INSTALLED indicates that the option is already available as part of the modems feature set.

HW & KEY REQ indicates that additional hardware is required to support the option. Contact your Radyne sales representative for more information regarding the required hardware upgrade.

KEY CODE REQ indicates that the desired option can be enabled as a demonstration from the front panel.

2. Contact Radyne with the Unit ID and Request a Demonstration.

   The modem's Unit ID can be found on the front panel as follows:

   a. From the modem's Main Menu, scroll right to the SYSTEM Menu.
   b. Scroll down.
   c. Scroll right to the HW/FW CONFIG Menu.
   d. Scroll down.
   e. Scroll right to the FEATURES Menu.
   f. Scroll down.

   The value displayed on the top line of this menu is the 12-digit Unit ID. It is displayed as on the front panel of the modem as 3 sets of 4 digits in a dot-delineated format as follows:

   1 2 3 4 . 1 2 3 4 . 1 2 3 4

   Your Radyne sales representative will ask you for this number along with the features you wish to demo.

3. Once your order has been processed, you will be issued a 12-digit demonstration code. This code can only be used one time and it is only good on the modem for which it was originally requested. To enter this code from the front panel, perform the following:

   a. From the modem's Main Menu, scroll right to the SYSTEM Menu.
   b. Scroll down.
   c. Scroll right to the HW/FW CONFIG Menu.
   d. Scroll down.
   e. Scroll right to the FEATURES Menu.
   f. Scroll down.

   The value displayed on the top line of this menu is the 12-digit Unit ID. It is displayed on the front panel of the modem as 3 sets of 4 digits. The second line is the data entry area and is displayed as 3 sets of 4 underscores in a dot-delineated format.

   Press <ENTER> and a cursor will begin flashing in the data entry area

   Using the numeric keypad, enter your 12-digit demonstration code
   Press <ENTER>.

   If the code entered is correct, the display will display CODE ACCEPTED, otherwise the display will read INVALID CODE.

Care should be taken to insure that the demonstration code is entered properly. After three unsuccessful attempts to enter a code, the front panel upgrade and demonstration capability will be locked out and it will be necessary to cycle power on the modem in order to continue.

B.4.1 Running in Demonstration Mode

Because of the possible interruption in traffic when the demonstration mode expires, several indicators are used to inform an operator that the modem is indeed, operating in demonstration mode. The most obvious of these is that the remote LED is flashing.

A second indication can be found on the Features Menu as follows:

1. From the modem's Main Menu, scroll right to the SYSTEM Menu.
2. Scroll down.
3. Scroll right to the HW/FW CONFIG Menu.
4. Scroll down.
5. Scroll right to the FEATURES Menu. The second line will display DEMO.

A third indication can be found in the upgrade list as follows:

1. From the FEATURES Menu.
2. Scroll down.
3. Scroll right to the UPGRADE LIST Menu.
4. Scroll down.
5. Scroll right through the available list of options.

The top line identifies the options and the second line identifies the options status.

DEMO MODE indicates that the option is has been temporarily activated and is now available for evaluation as part of the modems feature set.

At the end of the demonstration period, the modem will revert back to its permanent configuration. When it does, an interrupt in traffic will occur, regardless of whether or not a demo enabled features was being run at the time. In addition, operator intervention may be required to restore the data paths. In order to avoid this interruption in service, the user can cancel the demonstration at any time by following the instructions outlined in the section on Canceling Demonstration Mode.

B.4.2 Canceling Demonstration Mode

At any time, a demonstration may be canceled and have the modem return to its normal operation. Once the demonstration has been canceled, it cannot be restarted using the old demonstration code. In order to restart a demonstration, it will be necessary to obtain a new demonstration code.

To cancel a demonstration from the front panel, perform the following:

1. From the modem's Main Menu, scroll right to the SYSTEM Menu.
2. Scroll down.
3. Scroll right to the HW/FW CONFIG Menu.
4. Scroll down.
5. Scroll right to the FEATURES Menu.
6. Scroll down.

The value displayed on the top line of this menu is the 12-digit Unit ID. It is displayed on the front panel of the modem as 3 sets of 4 digits in a dot-delineated format indicated in *Parameter Setup, Chapter 4*. The second line is the data entry area and is displayed as 3 sets of 4 underscores in a dot-delineated format.

Press <ENTER> and a cursor will begin flashing in the data entry area

Using the numeric keypad, enter 0000 0000 0000

Press <ENTER>.

The modem will immediately terminate the demonstration and the feature set will revert back to the permanent configuration.

The Mod and Demod Test LED's will stop flashing.

Appendix C. Carrier Control

C.1 States

The DMD2050 transmitter will turn off the carrier output automatically when the modem determines there is a major alarm. This is done to prevent the carrier from outputting an unknown spectrum and possibly disturbing adjacent carriers. This automatic drop of the carrier can be overridden by masking the alarm that is causing the fault. This will keep the modulator output spectrum transmitting, even when the fault occurs. The following Carrier Control states are available:

- Carrier **OFF**
- Carrier **ON**
- Carrier **AUTO**
- Carrier **VSAT**
- Carrier **RTS**

C.2 Carrier Off

Modulator output is disabled.

C.3 Carrier On

Modulator output is turned off before reprogramming modulator functions that may alter the output spectrum through the front panel, and the user is required to enter “Yes” to re-enable output after the change. When using the terminal, the modulator is turned off while re-programming modulator functions that may alter the output spectrum, and the user is required to manually turn on the output after the reprogramming.

C.4 Carrier Auto

Modulator output is turned off before reprogramming modulator functions that may alter the output spectrum through the front panel, but the output is automatically turned on after the change. When using the terminal, the modulator is turned off while re-programming modulator functions that may alter the output spectrum, and but the output is automatically turned on after the change.

C.5 Carrier VSat

Modulator output is turned off before reprogramming modulator functions that may alter the output spectrum through the front panel, and the user is required to enter "Yes" to re-enable output after the change. When using the terminal, the modulator is turned off while re-programming modulator functions that may alter the output spectrum, and the user is required to manually turn on the output after the reprogramming (same as "Carrier On"). Additionally "VSat" mode disables the modulators output is the modems demodulator does not have signal lock. When signal lock returns to the demodulator, the modems modulator turns the carrier back on.

C.6 Carrier RTS

Modulator output is turned off before reprogramming modulator functions that may alter the output spectrum through the front panel, and the user is required to enter "Yes" to re-enable output after the change. When using the terminal, the modulator is turned off while re-programming modulator functions that may alter the output spectrum, and the user is required to manually turn on the output after the reprogramming (same as "Carrier On"). Additionally "RTS" (Request To Send) mode enables the modulator's output based on the RTS lead of the data interface. When RTS is enabled on the data interface, the modulator turns on the carrier, when the RTS is disabled the modulator turns off the carrier.

Appendix D. Web Browser Setup Guide

D.1 Introduction

The DMD20/50/2050 Web Browser allows for connection to Radyne products through the Ethernet port. The Web interface allows for complete control and monitoring of all equipment parameters and functions via a 10Base-T Ethernet connection. Utilization of the Web browser is dependent upon proper set-up of the TCP-IP menus. For TCP-IP setup guidelines refer to Appendix G in the manual. For additional information on the various WEB configurations and descriptions refer to the Remote Protocol Manual MN-DMDREMOTEOP.

To verify that the Radyne product is configured with the Web interface, use the products front panel <SYSTEM> control screen and verify that the WEB sub menu is visible. Contact the Radyne Customer Service Department if the WEB feature is not displayed on the front panel to identify the product is upgradeable.

Utilization of the Web Browser requires proper setup of the TCP-IP menus. The unit is shipped from the factory with the Boot Mode configured as Default. Verify that the Boot Mode is set for Default. To access the unit via the Ethernet port, set the Boot Mode to IP TEST. This will set the IP parameter to an accessible address. If user wants to utilize an alternate address, user must set the Boot Mode to NON-VOL. Contact the IT manager for proper guidance to ensure setup is successful.

D.2 WEB Users Configuration

Radyne utilizes authentication and authorization together with a user database and a security Realm to design a secure site. This allows for the use of users and groups, where users are generally people that may access the system, and groups represent the position that users can hold.

The Modem's Front Panel has full administrative privileges, allowing the operator through the Front Panel Menu entries to perform monitor and control modem parameter settings, change other interface user names and passwords, and modify IP network settings.

The web user database consists of three users (USER 1, USER 2, USER 3), with initial default names of guest, oper, and admin. Access rights and authentication make it possible to restrict access to a specified set of web users. There are three levels of security privileges that can be assigned to any user. They are:

- GUEST: Users are able to navigate most of the site, and view modem parameter settings.
- OPER: Users can monitor and control modem parameter settings, and change their own authentication passwords.
- ADMIN: At this highest access right, users can monitor and control modem parameter settings, change any user's name and authentication password, and modify IP network settings. This setting has full access to the entire site.
- NO GROUP: Assigning this will block all access from the site.

Listed in the table below are the factory default user names and corresponding default passwords and settings:

USER ID	Access Group	Authentication Password	Web User
USER 1	GUEST	guest	guest
USER 2	OPER	oper	oper
USER 3	ADMIN	admin	admin

All entries are case sensitive.

Using the Front Panel display and arrow keys, scroll thru the System menu until the WEB sub menu is displayed. Enter into the WEB menu and the following Sub menus will appear (order may vary).

1. **CONFIRMATION**: When ENABLED, a change in the Web Interface will prompt a secondary window to be displayed asking "Do you want to proceed". This will allow the user to either OK the change or cancel the change. When this feature is DISABLED, the command will be executed upon entering the command or parameter change. Commands pertaining to frequency and data rates cannot be overridden. The Confirmation command is located under PASSWORD SETUP/PREFERENCES.

2. **USER 1**: This will allow the operator to change the user name, assign the Access group, authorized password for "USER 1". Upon entering the following fields will be displayed:

    a. **ACCESS GROUP:** This will allow the assignment of "No Group", "ADMIN", "OPER", or GUEST to USER 1.
    b. **AUTH PASSWORD:** This will allow for the entry of the password for USER 1.
    c. **USER RESET:** Using this command will allow the factory defaults (as listed in the table above) to be restored to USER 1. This can be used in the event that USER 1 is locked out due to password restriction.

3. **USER 2**: This has the same menu structure as USER 1.

4. **USER 3**: This has the same menu structure as USER 1.

    Radyne's Web configuration allows for the support of 3 user profiles. These are configured through the 'PASSWORD/SETUP ACCESS section in the Web Browser.

D.3 Change Web User Name

Any of the three available user names can be modified.

1. Go to <USERx> Submenu, press <ENTER> then move the cursor to any position and press <CLEAR> along with the 'Right Arrow' key to clear all text to the right of the cursor.
2. Use the arrow keys and the numerical keypad to set the desired user name. Press <ENTER> to accept the changes.

D.4 Change Authentication Password

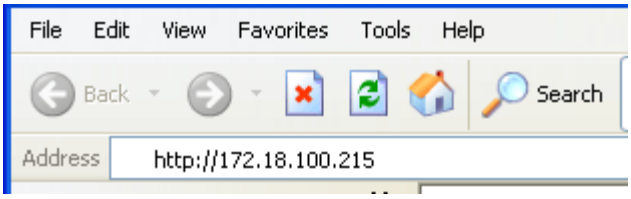
1. Go to <USERx> Submenu, press 'Down Arrow' to access its corresponding lower level sub-menus.
2. Go to <AUTH PASSWORD> Submenu, <ENTER> then move the cursor to any position and press <CLEAR> along with the 'Right Arrow' key to clear all text to the right of the cursor.
3. Use the arrow keys and the numerical keypad to set the desired password. Press <ENTER> to accept the changes.

D.5 Change Access Rights

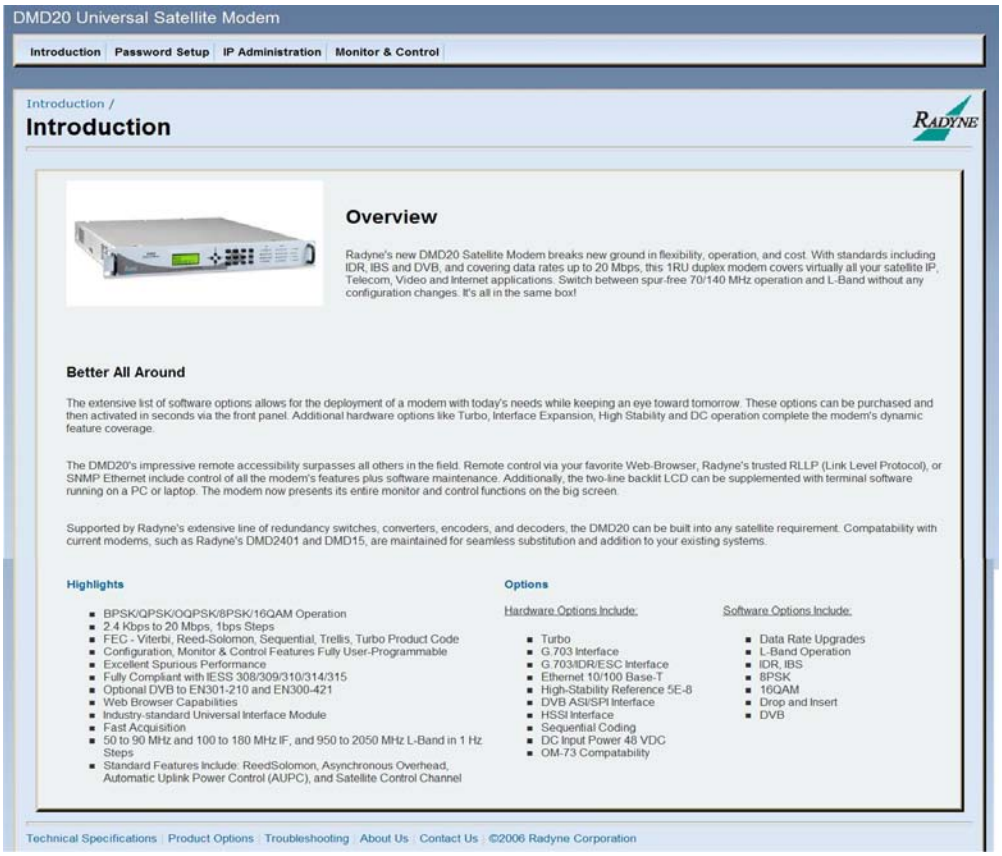
1. Go to <USERx> Submenu, press ‘Down Arrow’ to access its corresponding lower level sub-menus.
2. Go to <ACCESS GROUP> Submenu, <ENTER> then move the cursor to any position and press <CLEAR> along with the ‘Right Arrow’ key to clear all text to the right of the cursor.

D.6 Modem Web Site

Once it is determined that the modem is reachable, start the internet browser and type the modem IP address in the address field then press the Enter key.

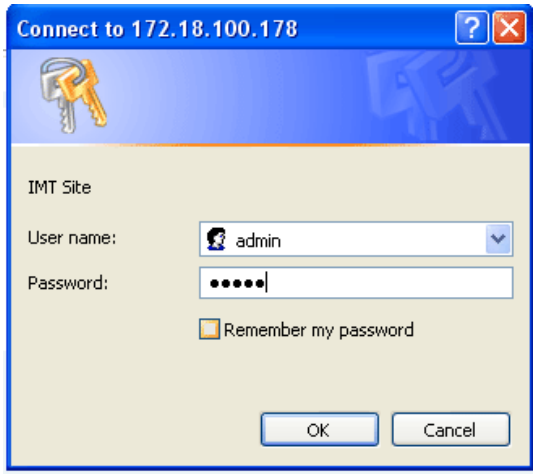


The equipment Introduction page will display general information, showing the equipment type, an overview of the equipment features and capabilities, and available hardware and software options. Complete technical specifications, and product options are also available in a PDF format at the bottom of the screen. Links to the Radyne Corporation website and Customer service is also accessible provided access to the internet is available.


DMD20 Universal Satellite Modem
Introduction
Password Setup
IP Administration
Monitor & Control
Introduction /
Introduction
RADYNE
Overview
Radyne's new DMD20 Satellite Modem breaks new ground in flexibility, operation, and cost. With standards including IDR, IBS and DVB, and covering data rates up to 20 Mbps, this 1RU duplex modem covers virtually all your satellite IP, Telecom, Video and Internet applications. Switch between spur-free 70/140 MHz operation and L-Band without any configuration changes. It's all in the same box!
Better All Around
The extensive list of software options allows for the deployment of a modem with today's needs while keeping an eye toward tomorrow. These options can be purchased and then activated in seconds via the front panel. Additional hardware options like Turbo, Interface Expansion, High Stability and DC operation complete the modem's dynamic feature coverage.
The DMD20's impressive remote accessibility surpasses all others in the field. Remote control via your favorite Web-Browser, Radyne's trusted RLLP (Link Level Protocol), or SNMP Ethernet include control of all the modem's features plus software maintenance. Additionally, the two-line backlit LCD can be supplemented with terminal software running on a PC or laptop. The modem now presents its entire monitor and control functions on the big screen.
Supported by Radyne's extensive line of redundancy switches, converters, encoders, and decoders, the DMD20 can be built into any satellite requirement. Compatability with current modems, such as Radyne's DMD2401 and DMD15, are maintained for seamless substitution and addition to your existing systems.
Highlights
BPSK/QPSK/OQPSK/8PSK/16QAM Operation
2.4 Kbps to 20 Mbps, 1bps Steps
FEC - Viterbi, Reed-Solomon, Sequential, Trellis, Turbo Product Code
Configuration, Monitor & Control Features Fully User-Programmable
Excellent Spurious Performance
Fully Compliant with IESS 308/309/310/314/315
Optional DVB to EN301-210 and EN300-421
Web Browser Capabilities
Industry-standard Universal Interface Module
Fast Acquisition
50 to 90 MHz and 100 to 180 MHz IF, and 950 to 2050 MHz L-Band in 1 Hz Steps
Standard Features Include: ReedSolomon, Asynchronous Overhead, Automatic Uplink Power Control (AUPC), and Satellite Control Channel
Options
Hardware Options Include:
Turbo
G.703 Interface
G.703/IDR/ESC Interface
Ethernet 10/100 Base-T
High-Stability Reference 5E-8
DVB ASI/SPI Interface
HSSI Interface
Sequential Coding
DC Input Power 48 VDC
OM-73 Compatability
Software Options Include:
Data Rate Upgrades
L-Band Operation
IDR, IBS
8PSK
16QAM
Drop and Insert
DVB
Technical Specifications | Product Options | Troubleshooting | About Us | Contact Us | ©2006 Radyne Corporation

WEB Browser Introduction Page

To navigate to other parts of the site, the modem needs to know who the user is to allow assignment of the proper level of transactions and resources. This authentication is done through the use of a username and password. The following screen will pop-up as soon as entry is requested into any other web pages (i.e. Password Set-up, IP Administration, and Monitor and Control). The factory default User Name and password defaults are listed above.
Enter “admin” for the user name and “admin” for the password to gain access with full privileges to the other pages within the browser.

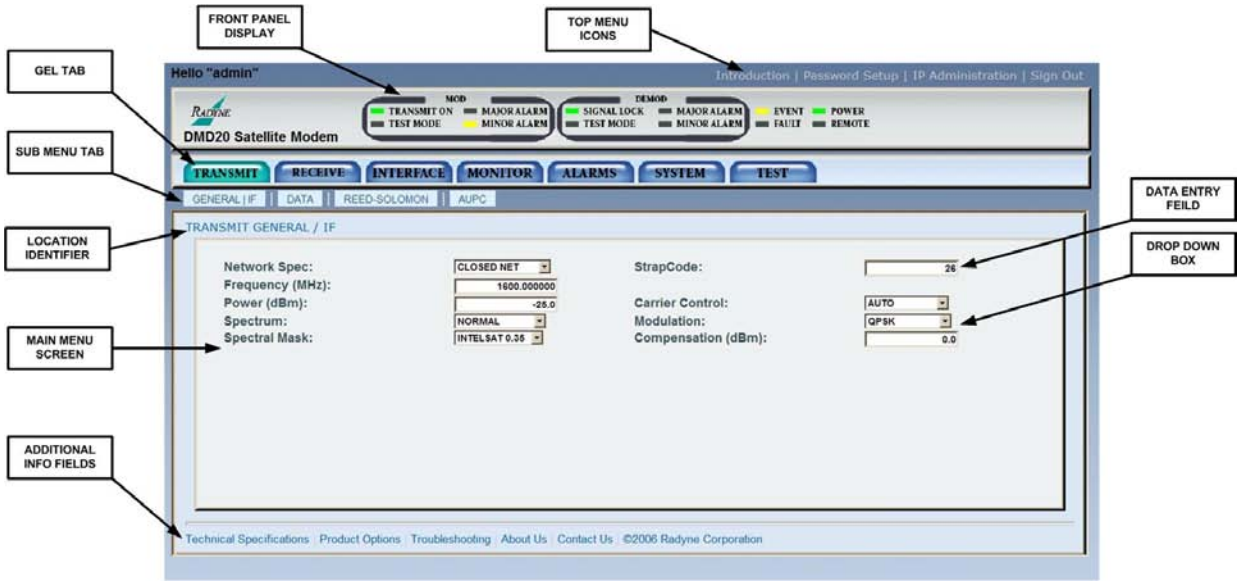


Login Window

Upon completion of a successful login, the user will be able to access the other screens within the Web Browser.

D.7 Web Page Appearance

This page displays the Monitor and Control section of the modem web interface. With a front panel look and feel, and an appearance that resembles the DMD50 layout.



Monitor and Control Web Page

The top of the web page displays an alarm section reflecting the current front panel status of the modem. This block will be updated immediately whenever status is changed.

The navigation scheme consists of gel tabs that correspond to the front panel top-level menu selections. When the mouse is dragged over a tab, it gets highlighted with a rollover effect and a sub-level of selections is revealed. These correspond to the front panel sub-menus.

Below the menu gel tabs, the main menu section will reflect the current programmed control state. At the top of the page, breadcrumb location identifier reminds the user how the page is selected (Location Identifier).

There is a simple navigation scheme that consists of gel tabs centralized on the main page.

Notes:

Appendix E. Strap Codes

E.1 Strap Codes

The Strap Code is a quick set key that sets many of the modem parameters. For quick setup of the modem, Strap Codes are very helpful. When a Strap Code is entered, the modem is automatically configured for the code's corresponding data rate, overhead, code rate, framing, scrambler type and modulation. An example of how to set a strap code follows:

Example: At the Front Panel <Modulator> Menu, depress '↓', then move '→' to the 'Strap Code' Submenu and enter #16. The modem will be automatically configured to the parameters shown below in the highlighted row 'Strap Code 16'.

Use the Strap Code Guide (Table D-1) for available strap codes.

Table D-1. Strap Codes

Strap Codes **Dis = Disable**										
Strap Code (Decimal)	**Data Rate (Kbps)**	**Overhead**	**Code Rate**	**Type**	**Framing Type**	**Scrambler Type**	**Drop and Insert**	**Reed-Solomon**	**Modulation**	**Mode**
1	64	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
2	128	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
3	256	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
5	384	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
6	512	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
9	768	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
4	1536	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
10	1920	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS

Strap Codes Dis = Disable										
Strap Code (Decimal)	**Data Rate (Kbps)**	**Overhead**	**Code Rate**	**Type**	**Framing Type**	**Scrambler Type**	**Drop and Insert**	**Reed-Solomon**	**Modulation**	**Mode**
8	2048	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
12	2048	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
16	1544	96K	3/4	VIT	IDR	V.35 (IESS)	Dis	Dis	QPSK	IDR
32	2048	96K	3/4	VIT	IDR	V.35 (IESS)	Dis	Dis	QPSK	IDR
64	6312	96K	3/4	VIT	IDR	V.35 (IESS)	Dis	Dis	QPSK	IDR
128	8448	96K	3/4	VIT	IDR	V.35 (IESS)	Dis	Dis	QPSK	IDR
24	56	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
33	56	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
34	64	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
36	64	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
40	128	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
48	128	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
65	256	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
66	256	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
68	320	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
72	320	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
80	384	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
96	384	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
129	512	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
130	512	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
132	768	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
136	768	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
144	896	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
44	896	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
7	1344	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
11	1344	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
13	1536	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
14	1536	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
19	1544	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
21	1544	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT

Strap Codes Dis = Disable										
Strap Code (Decimal)	**Data Rate (Kbps)**	**Overhead**	**Code Rate**	**Type**	**Framing Type**	**Scrambler Type**	**Drop and Insert**	**Reed-Solomon**	**Modulation**	**Mode**
22	1920	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
25	1920	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
26	2048	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
28	2048	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
37	2368	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
38	2368	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
41	48	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
160	1544	965/1024	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
52	1920	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
69	6312	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
70	8448	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
73	3152	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
74	3152	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
76	3264	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
81	3264	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
88	512	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
97	1024	1	1/2	VIT	CNT	V.35 (IESS)	Dis	Dis	QPSK	CNT
98	1024	1	3/4	VIT	CNT	V.35 (IESS)	Dis	Dis	QPSK	CNT
112	64	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
131	128	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
133	256	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
134	192	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
137	192	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
138	320	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
140	320	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
145	384	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
100	448	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
146	448	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
104	576	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
148	576	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT

Strap Codes Dis = Disable										
Strap Code (Decimal)	**Data Rate (Kbps)**	**Overhead**	**Code Rate**	**Type**	**Framing Type**	**Scrambler Type**	**Drop and Insert**	**Reed-Solomon**	**Modulation**	**Mode**
152	640	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
161	640	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
162	704	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
164	704	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
168	768	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
193	832	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
194	832	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
196	896	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
208	896	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
224	960	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
15	960	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
23	1024	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
27	1024	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
29	1536	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
30	1088	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
39	1088	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
43	1152	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
46	1152	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
51	1216	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
53	1216	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
54	1280	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
57	1280	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
58	1344	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
67	1408	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
71	1408	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
75	1472	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
77	1472	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
78	1600	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
83	1600	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
85	1664	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT

Strap Codes Dis = Disable										
Strap Code (Decimal)	Data Rate (Kbps)	Overhead	Code Rate	Type	Framing Type	Scrambler Type	Drop and Insert	Reed-Solomon	Modulation	Mode
86	1664	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
89	1728	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
90	1728	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
92	1792	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
99	1792	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
101	2048	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
102	1856	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
105	1856	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
106	2048	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
120	1544	965/1024	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	IBS
135	1984	16/15	1/2	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
139	1984	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT
45	3088	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
141	3088	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
176	4000	1	1/2	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
116	4000	1	3/4	VIT	NONE	V.35 (IESS)	Dis	Dis	QPSK	CNT
60	1344	16/15	3/4	VIT	IBS	IBS	Dis	Dis	QPSK	CNT

E.2 Sample Applications

The following section provides brief application notes for operating the modem and explains by example how to configure the modem for some of the most popular configurations.

The following information illustrates the allowable combinations for Mode and Data Rate.

Allowable Combinations: Mode/Rate/Framing.

IDR:

8.448 Mbps	3/4, 7/8 Rate FEC
6.312 Mbps	1/2, 3/4, 7/8 Rate FEC
2.048 Mbps	1/2, 3/4, 7/8 Rate FEC
1.544 Mbps or Below	1/2, 3/4, 7/8 Rate FEC

IBS:

2.048 Mbps or below 1/2, 3/4, 7/8 Rate

Closed Network:

8.448:	96 Kb Framing or No Framing, 3/4, 7/8 Rate FEC
6.312:	96 Kb Framing or No Framing, 1/2, 3/4, 7/8 Rate FEC
2.048:	96 Kb Framing or 1/15 Framing or No Framing, 1/2, 3/4, 7/8 Rate FEC
1.544:	96 Kb Framing or 1/15 Framing or No Framing, 1/2, 3/4, 7/8 Rate FEC
Any Rate 2.048 & lower:	1/15 Framing or No Framing, 1/2, 3/4, 7/8 Rate FEC

E.3 Operational Case Examples

For best results always begin setup by setting the data rate to 512 Kbps. This data rate is applicable for all modes and as such provides a convenient launch point for setting up the modem. Any mode of operation can be entered from this starting point.

E.3.1 Case 1: IDR 8.448 Mbps, 3/4 Rate Viterbi

Starting with the Data Rate = 512 Kbps

Modulator:

Method 1 -

Under Interface Menu:
Set Interface type
Set Tx clock selection
Set mode to IDR
Under Mod Data Menu:
Set code rate to 3/4 VIT
Set data rate for 8448000
Under Mod IF Menu: Set desired Tx frequency and power level
Turn IF ON

Method 2 -

Under Interface Menu:
Set Interface type
Set Tx clock selection
Set Mod strap code to: 128
Under Mod IF Menu: Set desired Tx frequency and power level
Turn IF on

Demodulator:

Method 1 -

Under Interface Menu:
Set Interface type
Set Buff clock selection
Set Buffer Size
Set mode to IDR
Under Demod IF Menu: Set desired Rx frequency
Under Demod data Menu:
Set code rate to 3/4 VIT
Set data rate for 8448000

Method 2 -

Under Interface Menu:
Set Interface type
Set Buff clock selection
Set Buffer Size
Set Demod strap code to 128
Under Demod IF Menu, set desired Rx frequency

E.3.2 Case 2: IBS 1.544 Mbps, 3/4 Rate Viterbi

Starting with the Data Rate – 512 Kbps

Modulator:

Method 1 -

Under Interface Menu:
Set Interface type
Set Tx clock selection
Set Framing to 1/15
Set mode to IBS
Under Mod Data Menu:
Set code rate to 3/4 VIT
Set data rate for 1544000

Under Mod IF Menu: Set desired Tx frequency and power level

Turn IF ON

Method 2 -

Under Interface Menu:
Set Interface type
Set Tx clock selection
Set Mod strap code to: 120
Under Mod IF Menu: Set desired Tx frequency and power level
Turn IF on

Demodulator:

Method 1 -

Under Interface Menu:
Set Interface type
Set Buff clock selection
Set Buffer Size
Set Framing to 1/15:
Set mode to IBS:
Under Demod IF Menu: Set desired Rx frequency
Under Demod Data Menu:
Set code rate to 3/4 VIT
Set data rate for 1544000
Under Interface Menu:
Set Interface type
Set Buff clock selection
Set Buffer Size

Method 2 -

Under Interface Menu:
Set Interface type
Set Buff clock selection
Set Buffer Size
Set Demod strap code to: 120
Under Demod IF Menu: Set desired Rx frequency

E.3.3 Case 3: Closed Network, 3/4 Rate Viterbi, IBS Overhead

Starting with the Data Rate = 512 Kbps

Modulator:

Method 1 -

Under Interface Menu:
Set Interface type
Set Tx clock selection

Set mode to IDR:
Under Mod Data Menu:
Set code rate to 3/4 VIT
Set Framing for 1/15
Under Mod IF Menu: Set desired Tx frequency and power level
Turn IF ON

Method 2 -

Under Interface Menu:
Set Interface type
Set Tx clock selection
Set Mod strap code to: 101
Under Mod IF Menu: Set desired Tx frequency and power level
Turn IF on

Demodulator:

Method 1 -

Under Interface Menu:
Set Interface type
Set Buff clock selection
Set Buffer Size
Set mode to: Closed Net
Under Demod IF Menu: Set desired Rx frequency
Under Demod data Menu:
Set code rate to 3/4 VIT
Set Framing for 1/15

Method 2 -

Under Interface Menu:
Set Interface type
Set Buff clock selection
Set Buffer Size
Set Demod strap code to: 101
Under Demod IF Menu: Set desired Rx frequency

E.3.4 Case 4: Loop Timing Example

Method 1 -

Under Interface Menu:
Under Tx Setup Menu:
Set INTF to RS-422
Set SCT Source to SCR
Set Tx Clock to SCTE
Set mode to IBS

Method 2 -

Under Interface Menu:
Under Tx Setup Menu:
Set INTF to RS-422
Set SCT Source to SCR
Set Tx Clock to SCTE
Set mode to Closed Net

Appendix F. TCP/IP Ethernet Setup

F.1 Introduction

The modem supports SNMP, FTP protocols and the Web Browser. Utilization of the protocols is dependent upon proper set up of the TCP-IP menus. This document is to be used only as a guideline for setting up the TCP-IP menus. Contact the IT manager for proper guidance to ensure setup is successful. For additional information on the various WEB or SNMP configurations and descriptions refer to the Remote Protocol MN-DMDREMOTEOP.

F.2 TCP/IP Network Configuration

Using the Front Panel display and arrow keys, scroll thru the System menu until the TCP / IP sub menu is displayed. Each unit requires proper configuration with the correct network settings. Contact the IT manager for a valid IP address mask, Modem, server and router IP addresses.

Enter into the TCP / IP menu and the following Sub menus will appear, however the order may vary.

1. **Boot Mode**: This allows for the selection of the operating boot mode for the TCP / IP. Several selections are available and are described below. When configuring the modem for Web Browser, Boot Mode must be set to "NON-VOL". A brief description of the available selections are:

   a. **Default**: If the Ethernet interface is not to be used, select this mode. No IP Address or mask changes will be allowed while in this mode of operation. The following parameters will be set and will not change until the boot mode is changed. The IP addresses are non accessible addresses.

      - IP MASK 255.000.000.000
      - MODEM IP ADDR 010.000.000.001
      - SERVER IP ADDR 010.001.001.001
      - ROUTER IP ADDR 010.000.001.001

   b. **BOOTp**: When enabled, at boot time, the modem will use the Bootp Protocol to automatically get names, masks, and IP Addresses of the modem, router, and server from the Network Manager. This should be consistent with the tag expected by the users

Bootp Server (see the next menu selection for setting the BOOTp TAG). If Bootp is not enabled, the modem will ignore the BOOTp Tag setting.

c. **NON-VOL**: This will allow for setting up all required IP Addresses and will store the information to the non-volatile memory. Upon power cycle, the modem will restore the saved settings into the correct fields.

d. **IP TEST**: The IP Test selection is similar in behavior to the Default selection. When enabled, the following preset parameters will be programmed and will not change until the selection is changed. To edit these parameters, change the boot mode to NON-VOL.

- IP MASK 255.255.255.000
- MODEM IP ADDR 192.168.000.238
- SERVER IP ADDR 192.168.000.101
- ROUTER IP ADDR 192.168.000.102

The DMD50 is shipped from the factory with the Boot Mode configured as Default. Verify that the Boot Mode is set for Default. To access the unit via the Ethernet port, set the selection to IP TEST. This will set the IP parameter to an accessible address. If user wants to utilize an alternate address, user must set the selection to NON-VOL. As an example, we will use a new modem IP address of 172.018.100.205 for the remaining of the TCP-IP setup procedure. Contact the IT manager for proper guidance to ensure setup is successful.

2. **BOOT SERVER TAG**: This allows for the selection of the operating boot tag when operating in the BOOTp Mode. The default setting of 206 is automatically selected when the boot mode is set to 'DEFAULT' (factory preset mode).

3. **MODEM HOST**: This displays the unit Host name that is operating, such as "DMD20". This is a read only display.

4. **IP ADDR MASK**: This will allow for the entry of the IP Address Mask. This will need to be entered based on the Network settings. Refer to your IP Administrator if you do not know this address for the correct address setting. Example IP Address Mask setting: 255.255.000.000.

5. **MODEM IP ADDR**: This will allow for the entry of the Modem's individual network IP Address. Each device on the network will have a unique address. Refer to the IT administrator for the correct address setting. Example Modem IP Address setting: 172.018.100.215.

6. **SERVER IP ADDR**: This allows for the setup of the Network Server IP Address. This section refers to the Host that will be used to optionally boot the DMD50 on power-up and is the SNMP Trap Server. This IP Address needs to be consistent with the Modem IP Address. Broadcast and loop back addresses will not be allowed. Example Server IP Address setting: 172.018.004.250.

7. **ROUTER IP ADDR**: This allows for the setup of the Network Router IP Address. If a router is present on the local network, and it is to be used, this address must be consistent with the IP Address Mask and the subnet of the modem. If no router is present, then the address should be set to a foreign address. Broadcast and loop back addresses will not be allowed. Router not used example: Router IP Address setting: 010.000.001.001.

8. **MODEM EADDR**: This displays the Modem (Unit) Ethernet Address. The Modem Ethernet Address is configured at the factory. It is a unique Radyne equipment identifier Address. Example: 0010650903EB

9. **ETHER RATE**: This displays the current Ethernet port data rate. If multiple rates are available, then a selection can be made to specify the Ethernet port data rate (10BaseT). Example Ethernet port Data Rate: 10 MBPS/HD

F.3 Network Configuration Summary

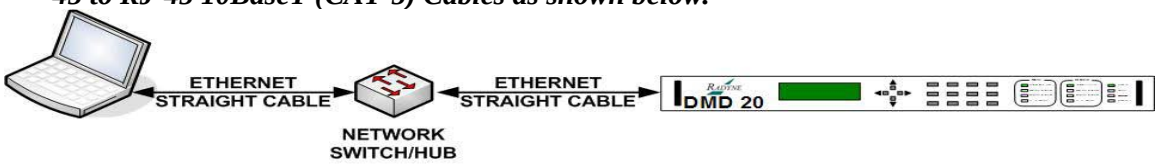
If the above steps were followed and the information was entered, then the following would be the TCP / IP configuration summary for a 'no router specified' setup:

1.	Boot Mode =	NON-VOL
2.	Bootp Server Tag =	206
3.	Modem Host=	DMD20
4.	IP Address Mask =	255.255.0.0
5.	Modem IP Address =	172.18.100.215
6.	Server IP Address =	172.18.4.250
7.	Router IP Address =	010.000.001.001
8.	Modem Ethernet Address =	0010650903EB
9.	Ethernet Rate =	10 MBPS/HD

F.4 Ethernet Test

Connecting the Modem Ethernet Cable to a Network Link

1. Connect the Network Switch (Hub) to the Modem Ethernet port (J9) using standard RJ-45 to RJ-45 10BaseT (CAT-5) Cables as shown below.

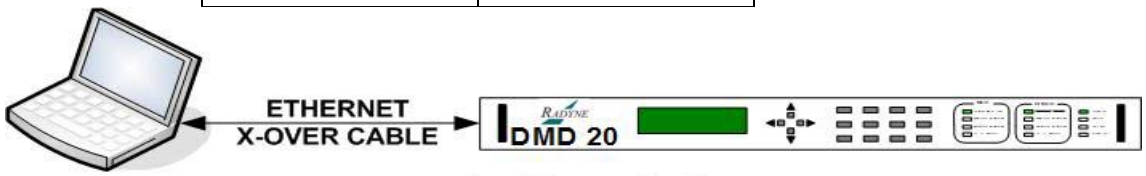


DMD20 Ethernet Network Connection

Connecting the Modem Ethernet Cable Directly to a Computer (without a Network)

The user can directly connect to the equipment without connecting to a network. This will often occur at remote sites where a network is not available. To connect, the user will need an Ethernet Crossover (Null) cable. The pinout for this cable is as follows,

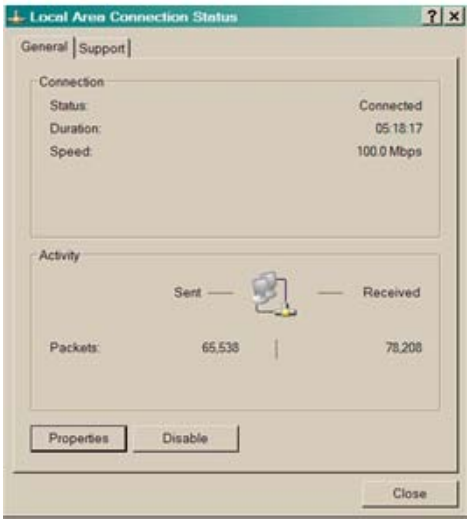
RJ45 Connector A	RJ45 Connector B
Pin #1	Pin #3
Pin #2	Pin #6
Pin #3	Pin #1
Pin #4	Pin #4
Pin #5	Pin #5
Pin #6	Pin #2
Pin #7	Pin #7
Pin #8	Pin #8



DIRECT CONNECTION

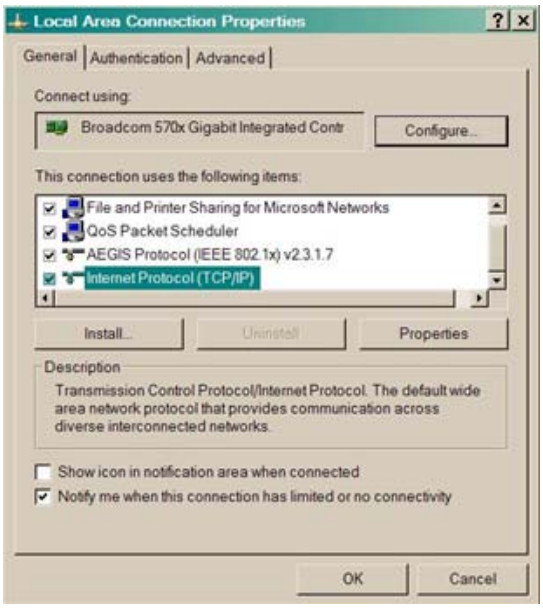
The Computer TCP/IP must be properly configured in order to obtain connectivity. The following set-up procedure can be used as a guide to aide in this setup. The following instructions apply only to Windows 2000 or XP Classic.

1. Click on the Start Button. Select Settings and click on the Control Panel Icon. Double click the Network Connections Icon.
2. Select the Local Area Connection icon for the applicable Ethernet adapter. Usually it is the first Local Area Connection listed. Double click the Local Area Connection. Click on the Properties icon.



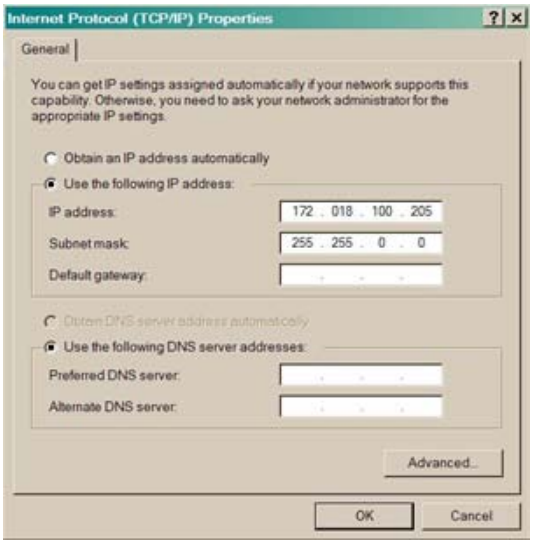
Local Area Connection Status Box

3. Make sure that the box next to the Internet Protocol (TCP/IP) is checked. Highlight Interconnect Protocol (TCP/IP) and click on the Properties button.



Local Area Connection Properties Box

4. Select "Use the following IP Address". Enter in the IP Address that is offset by 5 or so numbers from the equipment address (the computer and the equipment that it is connecting to can not have identical addresses) and Subnet Mask (this is identical to the subnet mask programmed into the equipment) into the corresponding fields. Click the OK button to complete the PC Configuration. Note: some computers may require that the computer be restarted for the changes to take effect.


Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
172 . 018 . 100 . 205
Subnet mask:
255 . 255 . 0 . 0
Default gateway:
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Internet Protocol (TCP/IP) Properties Box

5. To reconnect the computer to a network, select the "Obtain an IP address automatically" selection in the screen shown above.

F.5 Testing the Ethernet Connection using the Ping Program (Optional)

To verify that connectivity and settings are correct, use the Ping command to report if the Host (Equipment) is correctly responding. This is accomplished by opening the MSDOS Command Prompt and executing a Ping command as shown in the following example.

1. Open MSDOS Command Prompt. The Screen will display:

   Microsoft Windows XP [Version 5.1.2600]
   (C) Copyright 1985-2001 Microsoft Corp.

2. At the Command Prompt Enter "ping 172.18.100.215" (Enter the IP Address of the equipment to be tested). The screen will display:

   Microsoft Windows XP [Version 5.1.2600]
   (C) Copyright 1985-2001 Microsoft Corp.

   C:\> ping 172.18.100.215

3. If the ping is successful the screen will display:

   C:\>ping 172.18.100.215

   Pinging 172.18.100.215 with 32 bytes of data:

   Reply from 172.18.100.215: bytes=32 time=109ms TTL=64
   Reply from 172.18.100.215: bytes=32 time<1ms TTL=64
   Reply from 172.18.100.215: bytes=32 time=2ms TTL=64
   Reply from 172.18.100.215: bytes=32 time=123ms TTL=64

   Ping statistics for 172.18.100.215:
   Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
   Approximate round trip times in milli-seconds:
   Minimum = 0ms, Maximum = 123ms, Average = 58ms

4. If the ping is unsuccessful the screen will display:

   C:\>ping 172.18.100.215

   Pinging 172.18.100.215 with 32 bytes of data:

   Request timed out.
   Request timed out.
   Request timed out.
   Request timed out.

   Ping statistics for 172.18.100.215:
   Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

Check the following items that may lead to the unsuccessful response:

a. Verify that the correct cables are connected to the Ethernet port and that they are secured.
b. The Link Light is illuminated.
c. The IP Address that is used matches the Modem's IP Address.
d. The Server and Modem are on the same subnet.

Notes:

Appendix G. AUPC Operation

G.1 Automatic Uplink Power Control (AUPC Operation)

The modem has an optional built-in provision for Automatic Uplink Power Control, AUPC. AUPC is useful when operating power levels are affected by environmental changes in the atmosphere. AUPC attempts to adjust local power output to maintain a constant E_b/N_o at the receiver location.

The modem supports three versions of AUPC. They include Radyne AUPC, EF AUPC and Near Side AUPC. Radyne AUPC and EF AUPC use satellite overhead to send messages between the local and remote ends of an SCPC link. The messaging is done with IBS 1/15 and EF AUPC Framing messages.

G.1.1 Radyne AUPC

In this case, Target E_b/N_o indicates the remote value the local unit wants to maintain by adjusting the local power level.

Radyne AUPC can be set to operate on either or both directions of a link but always require a bi-directional channel. Enabling AUPC on one side of the link will activate AUPC on the distant end of the link. It is necessary that both the Modulator and Demodulator be set to the appropriate framing for AUPC options to be editable and for the AUPC function to operate properly.

Examples of the basic Radyne AUPC Operations are described as follows:

Assume that the two modems, one at each end of the link, are set to Radyne AUPC operation. Only one direction is discussed, but the same functions could be occurring in both directions simultaneously.

Local Modem is transmitting to Remote modem under normal conditions and the Remote modem has a receive E_b/N_o of 7.5 dB. Local modem has been set to a Target E_b/N_o of 7.5 dB with an output power level of -15 dBm.

It begins raining at Remote site and the E_b/N_o drops to –7.0 then –6.8 dB. Remote Modem is constantly sending update messages of its E_b/N_o to Local modem. When Local modem sees the

drop in the remote E_b/N_o, it slowly begins to raise the output power, and will continue to adjust if the remote E_b/N_o continues to drop. As the rain increases in intensity, the remote E_b/N_o decreases but Local modem continues to increase its power level to compensate.

When the rain diminishes, Local modem will see the remote E_b/N_o begin to increase. Local modem will lower its power level. The operation is therefore a feedback control loop with the added complication of a significant time delay.

G.1.2 EF AUPC

In EF AUPC mode, the Target E_b/N_o indicates the local unit wants the remote unit to maintain a power level sufficient to provide the local E_b/N_o value.

EF AUPC can be set to operate on either or both directions of a link but always require a bi-directional channel. Enabling AUPC on one side of the link will activate AUPC on the distant end of the link. It is necessary that both the Modulator and Demodulator be set to the appropriate framing for AUPC options to be editable and for the AUPC function to operate properly.

Examples of the basic EF AUPC Operations are described as follows:

Assume that the two modems, one at each end of the link, are set to AUPC operation. Only one direction is discussed, but the same functions could be occurring in both directions simultaneously.

The local modem is transmitting to modem at a remote locale under normal conditions. The remote modem has a receive E_b/N_o of 7.5 dB. The local modem has been set with a Target E_b/N_o of 7.5 dB, and has a current power output of –15 dBm.

It begins to rain at the local site, and the E_b/N_o drops to –7.0 then –6.8 dB. The local modem is constantly sending update messages of its E_b/N_o to the remote modem. When the remote modem sees the drop in the E_b/N_o, it slowly begins to raise it's output power, and will continue to do so until the Target E_b/N_o is restored at the local site.

When the rain diminishes, the local modem's E_b/N_o will begin to increase. The remote modem will now lower its power level to restore the target value. The operation is therefore a feedback control loop with the added complication of a significant time delay.

G.1.3 Near Side AUPC

Near Side AUPC is a loop back system that adjusts the broadcast uplink signal when local conditions change. This is done by having the Near Side AUPC attempt to adjust the outbound power to compensate for local weather.

The local receiver must be tuned and locked to the transmitter and then the internal E_b/N_o, is used for feedback. This creates a Tx-Satellite-Rx control loop.

Near Side AUPC is primarily used for broadcast applications since the modem cannot expect to receive data from a distant location. Near Side AUPC can be utilized with any satellite framing or Network mode.

There are safeguards built into the AUPC System. First, the modulator has two parameters, which allow control of the maximum and minimum output power Levels. Second, a nominal, or default, power level is specified which takes effect if the receive signal or messaging is lost. This nominal power should be set to a level high enough to re-establish communications regardless of rain fade.

EF AUPC, also provides some control over the rate of power change; while the Radyne and Near Side AUPC use a optimized rate for rain fade compensation.

The AUPC Menu Functions and their descriptions are shown on Table G-1 ands G-2.

Table G-1. Local AUPC Functions

Local AUPC Functions		
Function	**AUPC Available Options**	**Description**
AUPC MODE	DISABLE, NEARSIDE, RADYNE, EFDATA	Enables/Disables the AUPC to function locally
NOMINAL POWER	0 TO -25 dB	Sets default output power to be used
MINIMUM POWER	0 TO -25 dB	Sets minimum output power to be used
MAXIMIM POWER	0 TO -25 dB	Sets maximum output power to be
TARGET Eb/No	4.0 TO 16 dB	Desired E_b/N_0 of remote modem
TRACKING RATE	6.0 to 0.5 dB/MIN	Adjustable in .5dB increments
LOCAL CL ACTION	HOLD, MAXIMUM, NOMINAL	Allows user to determine what power setting the remote modem will use in the event of a carrier loss at the local side.
REMOTE CL ACTION	HOLD, MAXIMUM, NOMINAL	This setting allows users to determine what local output power setting to use in the event that the remote end has a carrier loss.

1. The AUPC Menus are located under the Modulator Menu as shown in Section 4.
2. The EF AUPC Menu displays when EFAUPC Framing is enabled in the Demod and Mod set up menus.
3. Highlighted areas are activated when modem is set to EF AUPC

Table G-2. Remote AUPC Functions

Remote AUPC Functions (EF AUPC Only)		
Function	**AUPC Available Options**	**Description**
AUPC MODE	Disable, EFDATA	Enables/Disables the AUPC to function remotely
LOOPBACK	Enabled/Disabled	Loop back test over satellite link
TX 2047 TEST BER	Enabled/Disabled	Initiates 2047 Test pattern BER Test
RX 2047 BER	Status Menu	Identifies the BER status on the distant RX side
AUPC DEF LVL		Sets default output power to be used
The Remote AUPC Menus are only supported by EFAUPC		

Appendix H. Drop and Insert (D&I)

H.1 Drop and Insert (D&I)

The Drop and Insert (D&I) function provides an interface between a full T1 or E1 Trunk whose framing is specified in CCITT G.704 and a fractional Nx64 Kbps Satellite Channel. The Drop and Insert functionality conforms to IBS, small IDR, and Radyne Proprietary Efficient D&I Framing Structures. For information pertaining to Radyne proprietary Efficient Drop and Insert function, refer to Appendix I.

The Drop function allows the user to select the terrestrial T1 or E1 timeslots that are to be dropped off for transmission over the link in the specified satellite channels. The Insert function allows the user to select the T1 or E1 timeslots into which the received satellite channels are to be inserted. The two functions are completely independent allowing maximum flexibility in choosing configurations. The four-port G.703 Interface allows one or more modems to be looped together using the same T1 or E1 trunk.

The Transmit Data Trunk is brought into the modem via the Send Data In (SDI) Port. From there, the TX Baseband Processor extracts the selected timeslots from the G.704 Frame and prepares them for transmission. The original trunk data is sent out of the modem unaltered via the Send Data Out (SDO) Port. The Receive Data Trunk is brought into the modem via the Insert Data In (IDI) Port. The data is buffered inside the modem and the RX Baseband Processor inserts satellite data into the selected timeslots in the G.703 Frame. The modified terrestrial trunk is then output via the Receive Data Out (RDO) Port.

Figure H-1 shows two modems looped together. This configuration could be simplified to just use one modem, or extended to use more than two modems. Figure H-2 shows an alternative method of looping where all of the drop (transmit) data is processed prior to performing any insert (receive) processing. In both configurations, the terrestrial trunk is providing the timing for the satellite transmission and for the terrestrial receive.

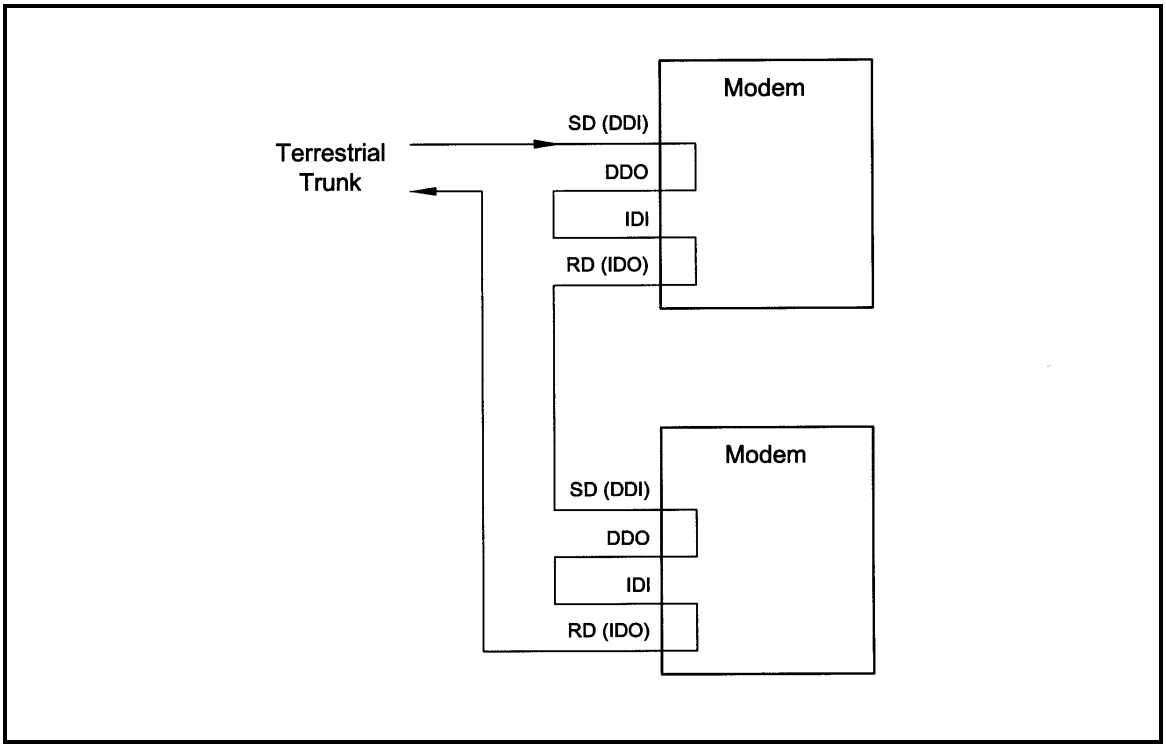


Figure H-1. Looped Modems

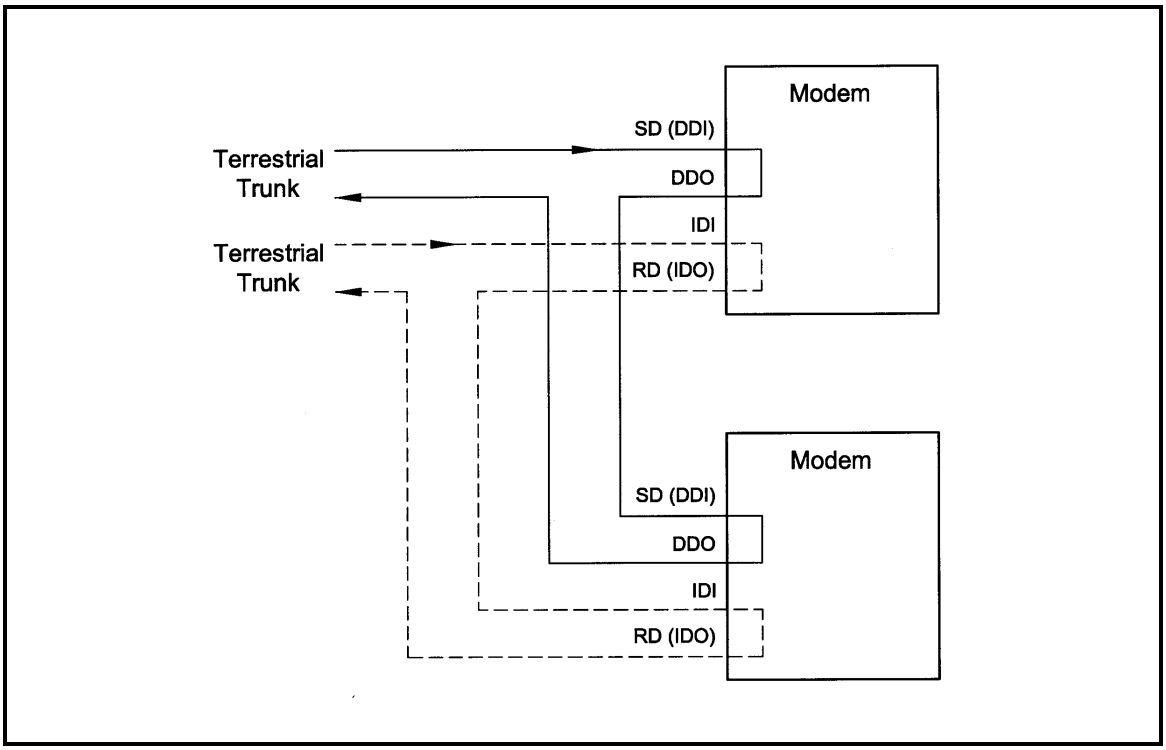


Figure H-2. Looped Modems with Separate D&I Trunks

H.1.1 Drop Only

When Drop is enabled and Insert is disabled, the unit performs a drop-only function. Framed E1 or T1 Data is input via the Send Data In Port, the selected timeslots are dropped into the IBS frame structure, and the unaltered terrestrial data is output via the Send Data Out Port (refer to Figure H-3).

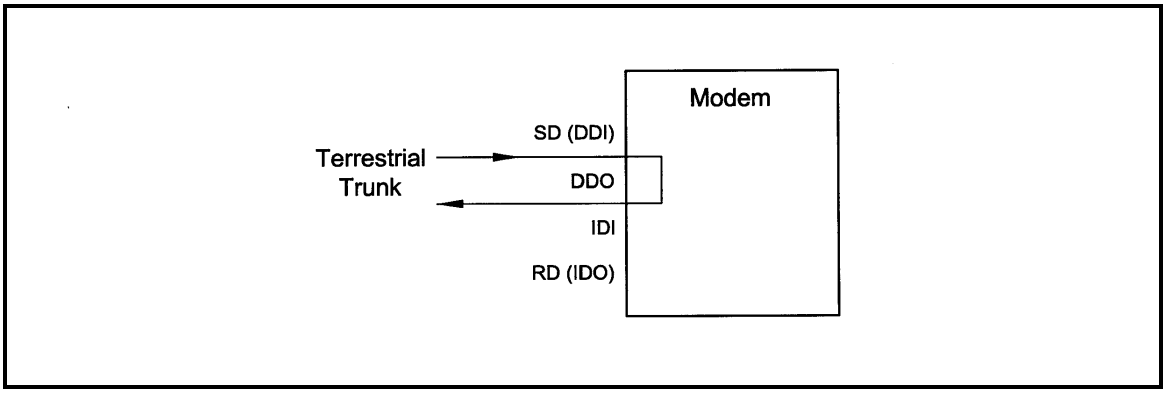


Figure H-3. Drop Only

H.1.2 Insert Only

When Insert is enabled and Drop is disabled, the unit performs an insert-only function. If framed terrestrial E1 or T1 Data is available, it should be input via the Insert Data In Port. The Terrestrial Data is buffered inside the Modem. The RX Baseband Processor inserts satellite data into the selected timeslots in the G.704 Frame and the modified terrestrial data is then output via the Receive Data Out Port (refer to Figure H-4).

If framed terrestrial data is not available, selection of the Internal T1/E1 frame source will cause the modem to generate the required G.704 Frame. The Satellite Data will be inserted into the selected timeslots, and the resulting terrestrial data will be output via the Receive Data Out Port. Any non-inserted timeslots in the G.704 Frame will be filled with the appropriate Idle Code (refer to Figure H-5).

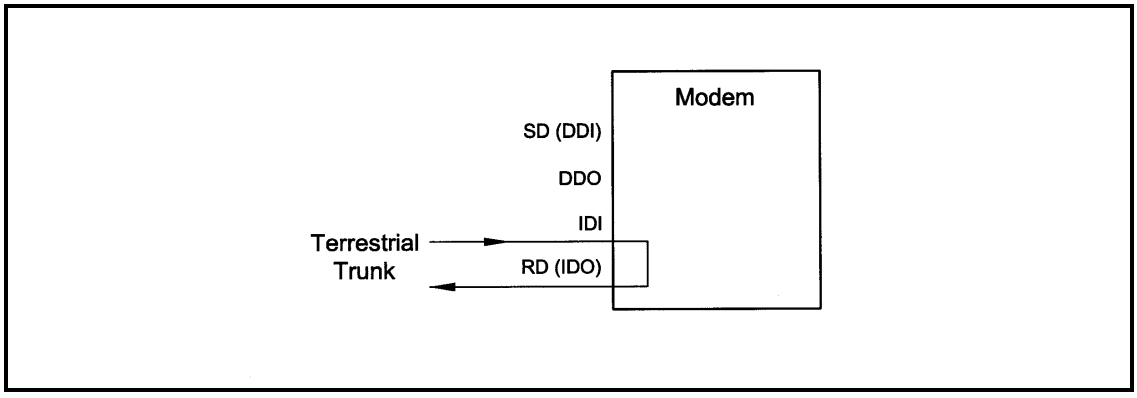


Figure H-4. Insert Only with Eternal Frame Source

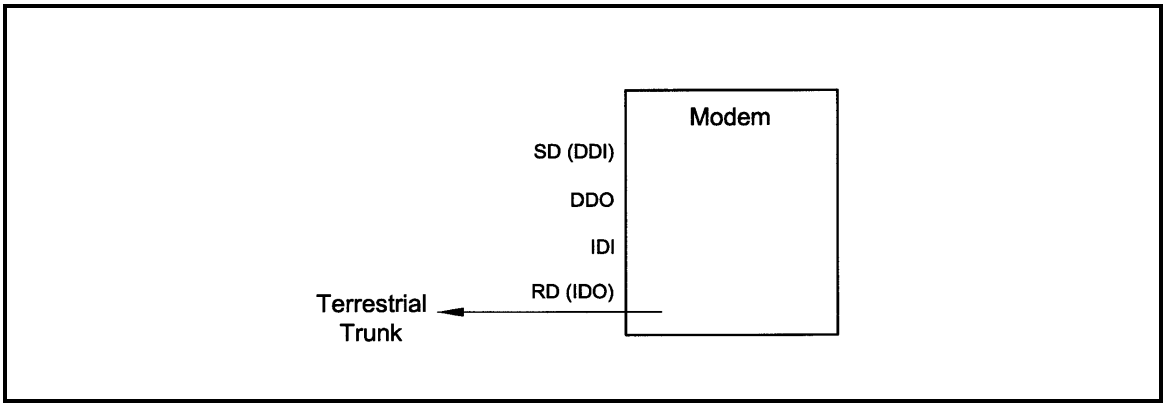


Figure H-5. Insert Only with Internal Frame Source

H.1.3 Mode Selection

D&I can be easily configured to support several commonly used terrestrial data formats. For E1 Data, the user can choose between PCM-30, PCM-30C, PCM-31 and PCM-31C. For T1 Data, the user can choose between T1-D4, T1-ESF, and SLC-96. The following paragraphs provide more information on the various mode selection capabilities.

H.1.3.1 PCM-30

The PCM-30 Mode of Operation supports an E1 Interface with Multiframe Alignment (MFAS) and Channel Associated Signaling (CAS). The user may independently program n timeslots to drop and n timeslots to insert where n = 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, or 30. In addition to the selected drop timeslots, the Transmit Function also extracts the appropriate ABCD signaling bits from terrestrial timeslot 16 for transmission in IBS Frame as required. Conversely, the Receive Function extracts received ABCD signaling bits from the IBS Frame and inserts them in timeslot 16 of the appropriate terrestrial frame. This transmission and reception of ABCD signaling based upon the drop and insert timeslots is performed automatically and is transparent to the user. In PCM-30 mode, the user may *not* select timeslot 16 as a Drop or Insert Timeslot.

H.1.3.2 PCM-30C

The PCM-30C Mode of Operation supports an E1 Interface with Multiframe Alignment (MFAS) and Channel Associated Signaling (CAS). In addition, the Drop function verifies the received terrestrial CRC checksum and the Insert function calculates the required CRC checksum. The user may independently program n timeslots to drop and n timeslots to insert where n = 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, or 30. In addition to the selected Drop timeslots, the Transmit Function also extracts the appropriate ABCD signaling bits from terrestrial timeslot 16 for transmission in IBS Frame as required. Conversely, the Receive Function extracts received ABCD signaling bits from the IBS frame and inserts them in timeslot 16 of the appropriate terrestrial frame. This transmission and reception of ABCD signaling based upon the Drop and

Insert timeslots is performed automatically and is transparent to the user. *In PCM-30C Mode, the user may not select timeslot 16 as a Drop or Insert Timeslot.*

H.1.3.3 PCM-31

The PCM-31 Mode of Operation supports an E1 Interface with no Multiframe Alignment (MFAS) or Channel Associated Signaling (CAS). The user may independently program n timeslots to drop and n timeslots to insert where n = 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, or 30. Because there is no implied ABCD signaling, the user is free to select timeslot 16 as a Drop *or* Insert Timeslot.

H.1.3.4 PCM-31C

The PCM-31C Mode of Operation supports an E1 Interface with no Multiframe Alignment (MFAS) or Channel Associated Signaling (CAS). In addition, the Drop Function verifies the received terrestrial CRC checksum and the Insert Function calculates the required CRC checksum. The user may independently program 'n' timeslots to drop and 'n' timeslots to insert where 'n' = 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, or 30. Because there is no implied ABCD signaling, the user is free to select timeslot 16 as a Drop *or* Insert Timeslot.

H.1.3.5 T1-D4/T1-D4-S

The T1-D4 Mode of Operation supports a T1 Interface with 12 frames per multiframe. The user may independently program n timeslots to drop and n timeslots to insert where n = 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, or 30. Robbed Bit Signaling (RBS) is handled without any need for operator intervention and is transparent to the user.

H.1.3.6 T1-ESF/T1-ESF-S

The T1-ESF Mode of Operation supports a T1 Interface with 24 frames per multiframe. The CRC-6 checksum is automatically checked by the Drop Function and generated by the Insert Function and placed in the appropriate F-bit positions in the terrestrial multiframe. The user may independently program n timeslots to drop, and n timeslots to insert, where n = 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 16, 20, 24, or 30. Robbed Bit Signaling (RBS) is handled without any need for operator intervention and is transparent to the user.

H.1.4 Multidestinational Systems

Because the Drop and Insert Functions are completely independent, so multi-destinational communications are easily supported.. Figure H-6 illustrates a Multi-destinational System with one Hub site and three remote sites. At the Hub site, thirty channels are being transmitted to all three remote sites and a fractional set of channels is being received from each remote site. At the other end of the link, each remote site is transmitting a fractional E1 to the Hub site as well as receiving all 30 channels from the Hub site. It also identifies those channels intended for it, and inserts them into the terrestrial data stream.

H.1.5 Drop and Insert Mapping

The following displays under Interface D&I Setup (both Tx and Rx), are editing displays only:

SATCh TS
Enter to Edit

Any changes made in these displays are made on the screen, but *are not* entered into the modem. Once these menus are configured, the Mapping Menu must be used to actually enter the settings into the modem.

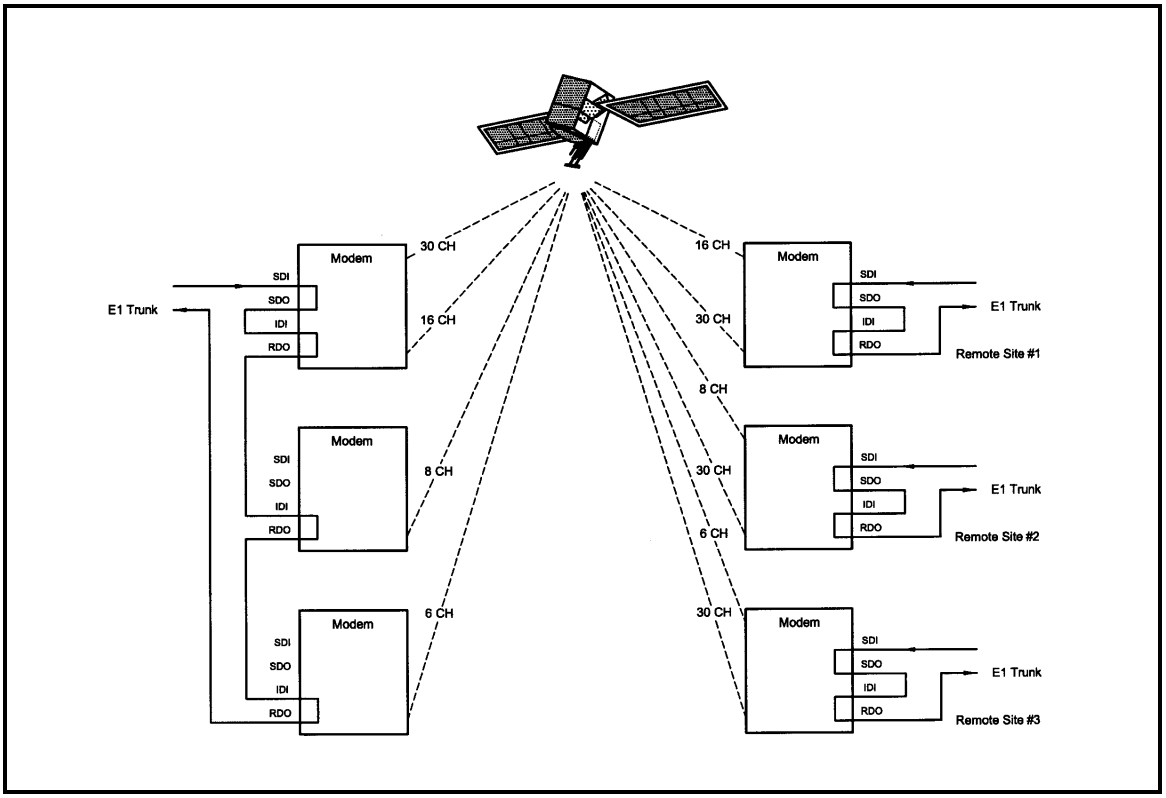


Figure H-6. Multidestinational Communications

Example :

For a modem w/ Drop & Insert enabled at a data rate of 256 (with timeslots assigned 1 - 1, 2 - 2, etc.). At a data rate of 256, the modem will allow 4 channels to assign timeslots. Under the Tx Menu, assign the timeslots that are to be used to the 4 channels. CH1 is assigned to TS1 (Timeslot #1), CH2 to TS 2, CH3 to TS3 and CH4 to TS4, <ENTER> must be depressed after assigning each individual TS. Once the timeslots are assigned to the channels, use the Left or Right Arrow Key to scroll to the Mapping Menu. This menu will appear in the following way:

Map Copy
********* *********

This is the menu where the channel assignments are actually entered into the modem. To do this, perform the following steps:

For the Transmit Side:

1. Push <ENTER> to get the flashing cursor.

2. Use the Up Arrow Key to make the left portion of the display read “TX EDIT”.

3. Use the Right or Left Arrow Keys to switch the flashing cursor to the right portion of the display.

4. Use the Up or Down Arrow Key to until the right hand portion displays “TX ACTIVE”.

5. The mapping display should now look like this:

Map Copy
TX EDIT > TX ACTIVE

6. Push <ENTER> to enter this command. This tells the modem to configure to the settings that were assigned in the Channel/Timeslot display.

For the Receive Side:

1. With Rx Side Channels configured as follows: CH1 to TS1, CH2 to TS2, CH3 to TS3, and CH4 to TS4.

2. After the timeslots are assigned properly, scroll to the Mapping Menu and use the above procedure to enter the settings into the modem.

3. Set the display to read:

Map Copy
RX EDIT > RX ACTIVE

4. Press <ENTER> to enter the settings into the modem.

To View the current Timeslot Assignment:

1. If there is a question of the channels not being entered properly, the Mapping Menu may be used to see how the channels/timeslots are configured in the modem.

2. Use <ENTER> and the Arrow Keys to make the mapping menu read (for the Tx Side):

Map Copy
TX ACTIVE > TX EDIT

3. Press <ENTER>. The modem has now copied the current Tx Settings to the Tx Channel/Timeslot Display.

4. For the Rx Side:

Map Copy
RX ACTIVE > RX EDIT

5. Press <ENTER>. The modem has now copied the current Rx Settings to the Rx Channel/Timeslot display).

It is not mandatory to assign timeslots in sequential order, although the lowest timeslot must be entered in the lowest channel. For example: timeslots may be assigned 1 - 2, 2 - 5, etc. but not 1 - 5, 2 - 2.

H.2 Configuring the Modem for Drop and Insert

Several dependencies exist when configuring the modem for Drop and Insert (D&I). The following paragraphs explain these dependencies and provide the user with the information required to ensure smooth transition into D&I and to minimize the potential impact of these dependencies.

H.2.1 Data Rate

Data Rate affects the Drop and Insert function in the following ways:

- It determines the number of Satellite Channels that will be displayed in the Edit Maps.

- It contributes to the Operational Mode selection process. Trying to change the Operational Mode to D&I when a data rate is not set to a valid D&I rate will result in the error message 'INVALID DATA RATE,' and the mode change will not be allowed.

- It contributes to the Terrestrial Framing Mode selection process. Trying to select a T1-type Drop Mode such as T1-ESF with the mod data rate set to 1920000 bps (a valid E1 D&I rate but not a valid T1 rate) will result in the error message 'INVALID DROP MODE' and the selection will not be allowed. Trying to select a T1 type Insert Mode such as T1-D4 with the demod data rate set to 1920000 bps will result in the error message INVALID INSERT MODE and the selection will not be allowed.

- Once D&I Mode has been selected, trying to change the data rate to something other than another valid D&I data rate will result in the error message 'RATE OUT OF BOUNDS' and the change will not be allowed.

- Once D&I Mode has been selected with a T1 Terrestrial Framing Mode, attempting to change the data rate to 1920000 will result in the error message 'RATE OUT OF BOUNDS' and the change will not be allowed.

Therefore, the data rate should be entered as the first step in configuring the modem for D&I. The Mod Data Rate should be set according to the number of timeslots to be dropped and the Demod Data Rate should be set according to the number of timeslots to be inserted. The following table gives the allowable D&I data rates based on the number of slots (n) to be dropped or inserted.

n = 1, data rate = 64000
n = 2, data rate = 128000
n = 3, data rate = 192000
n = 4, data rate = 256000
n = 5, data rate = 320000
n = 6, data rate = 384000
n = 8, data rate = 512000
n = 10, data rate = 640000
n = 12, data rate = 768000
n = 15, data rate = 960000
n = 16, data rate = 1024000
n = 20, data rate = 1280000
n = 24, data rate = 1536000
n = 30, data rate = 1920000 (valid with E1 Interface only)

H.2.2 Operational Network Specification

The Network Specification of the Modem often determines which additional menus and displays are available for use by the operator. The D&I Mode-specific menus will not be displayed unless the Network Specification of the modem is set to D&I. Therefore, the second step in configuring the modem should be to set the Network Specification to D&I. At this point, the D&I specific menus in the Interface section will become available and will remain available until the Network Specification of the modem is changed to something other than D&I.
When the Network Specification is changed to something other than D&I, the D&I specific menus will automatically disappear.

H.2.3 Terrestrial Framing - Drop Mode/Insert Mode

The Drop Mode Selection and the Insert Mode Selection identify the Terrestrial Data-Framing Format. As previously mentioned, their selection is influenced by the Modulator and Demodulator Data Rates, and trying to select a T1 Type Framing Format with a data rate of 1920000 bps will result in an error message. In turn, the selection of the terrestrial framing formats influences the satellite channel to terrestrial timeslot mappings in the following manner:

The selection of T1-D4, T1-ESF, or SLC-96 type terrestrial framing format limits the terrestrial timeslots to values from 1 - 24.

The selection of PCM-30 or PCM-30C type terrestrial framing limits the terrestrial timeslots to values from 1 - 15, 17 - 31. In these modes, terrestrial timeslot 16 is reserved for ABCD signaling and may not be dropped or inserted.

The selection of PCM-31 or PCM-31C type terrestrial framing limits the terrestrial timeslots to values from 1 - 31. Therefore, the terrestrial framing format should be identified via the Drop Mode and Insert Mode entries prior to editing the Drop or Insert satellite channel to terrestrial timeslot maps.

H.2.3.1 Insert Terrestrial Frame Source

The Insert Terrestrial Frame Source selection tells the Modem from where the Insert Terrestrial Frame is coming.

External: Indicates that the terrestrial frame is to be input via the Insert Data In Port.

Internal: Indicates that the modem needs to generate the terrestrial frame and that all non-inserted timeslots need to be filled with the appropriate idle code based upon the terrestrial framing (T1 or E1).

The selection of the Insert Terrestrial Frame Source also influences the Buffer Clock selection in the following manner:

When the Insert Terrestrial Frame Source selection is set to External, the received satellite data will be clocked out of the Doppler Buffer based upon the clock recovered from the insert data input. Therefore, the Buffer Clock selection will automatically be set to External and cannot be modified. Attempts to select a different buffer clock will result in the error message INVALID BUFFER CLOCK and the selection will not be allowed.

When the Insert Terrestrial Frame Source selection is set to Internal, the operator needs to specify how data should be clocked out of the Doppler Buffer. In this case, the operator will be able to select SCTE, SCT, RX SAT, or EXT EXC as the source for the Buffer Clock. Therefore, the Insert Terrestrial Frame Source selection should be made prior to attempting to change the Buffer Clock. In most instances, the Insert Terrestrial Frame Source selection will be set to External and the Buffer Clock will automatically be set to External.

H.2.4 D&I Sample Configurations and D&I Clock Setup Options

The following are several examples of how to configure the modem for D&I. Also, refer to Figures 3-14 through 3-17 for the D&I Clocking Setup Options Available.

Example 1: Drop 512 Kbps from a T1 trunk, 3/4 Rate Viterbi
Insert 512 Kbps into a T1 trunk, 3/4 Rate Viterbi
Drop 512 Kbps from a T1 trunk, 3/4 Rate Viterbi

Under Interface:
- Under TX Setup:
- Set Tx Type according to your hardware configuration (example: G703BT1B8ZS)
- Set Tx Clock = SCTE
- Under Tx D&I:
- Set Drop Mode = T1-D4
- Use SATCh TS edit capability to define desired mapping of Satellite Channels to drop Terrestrial Slots
- Use Map Copy to copy Tx Edit to Tx Active

Under Modulator:
- Under Mod Data:
- Set Data Rate = 512000
- Set Conv Enc = 3/4 Rate VIT

Under Modulator:
- Set Network Spec. = Drop & Insert

Under Interface:
- Under TX Setup:
- Set Tx Type according to your hardware configuration (example: G703BT1B8ZS)
- Set Tx Clock = SCTE
- Under Tx D&I:
- Set Drop Mode = T1-D4
- Use SATCh TS edit capability to define desired mapping of Satellite Channels to drop Terrestrial Slots
- Use Map Copy to copy Tx Edit to Tx Active

Under Modulator:
- Under Mod IF:
- Set Frequency to desired value
- Turn IF Output Power On

Under Demodulator:
- Under Demod Data:
- Set Data Rate = 512000
- Set Conv Enc = 3/4 Rate VIT

Under Interface:
Under RX Setup:
Set Rx Type according to your hardware configuration
Set Buff Size to desired depth
Under Rx D&I:
Set Insert Mode = T1-D4
Set T1 E1 Frm Src = External
Use SATCh TS edit capability to define proper mapping of Satellite Channels to insert Terrestrial Slots
Use Map Copy to copy Rx Edit to Rx Active
Under Demodulator:
Under Demod IF:
Set Frequency to desired value
Under Demodulator:
Set Network Spec. = Drop & Insert

Example 2: Multidestinational Remote Site Programming
Drop 512 Kbps from a T1 trunk, 3/4 Rate Viterbi.
Extract 512 Kbps from a 1536 Kbps carrier and insert into a T1 trunk, 3/4 Rate Viterbi.

Drop 512 Kbps from a T1 trunk, 3/4 Rate Viterbi
Configuration setup is exactly as previously shown in Example 1.

Extract 512 Kbps from a 1536 Kbps carrier and insert into a T1 trunk, 3/4 Rate Viterbi

Under Interface:
Under RX Setup:
Set Rx Type according to your hardware configuration
Set Buff Size to desired depth
Under Rx D&I:
Set Insert Mode = T1-D4
Set T1 E1 Frm Src = External
Use SATCh TS edit capability to define proper mapping of Satellite Channels to insert Terrestrial Slots
For Satellite Channels that are not to be inserted, enter “NI” (No Insert) for the Terrestrial Slot
Use Map Copy to copy Rx Edit to Rx Active

Under Demodulator:
Under Demod Data:
Set Data Rate = 1536000
Set Conv Enc = 3/4 Rate VIT

Under Demodulator:
Set Network Spec. = Drop & Insert

Under Demodulator:
Under Demod IF:
Set Frequency to desired value.

Figures H-7 through H-10 illustrate D&I Clock Setup Options

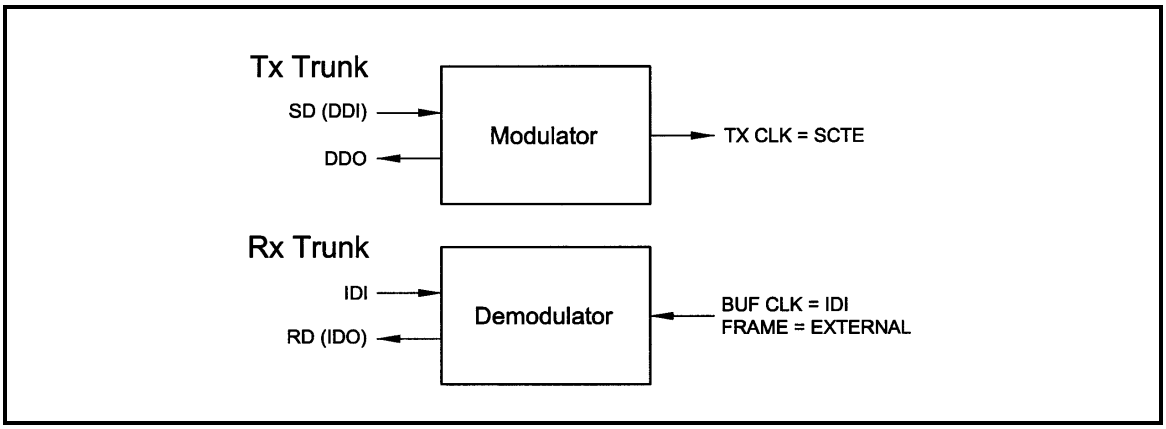


Figure H-7. Transmit Trunk and Receive Trunk

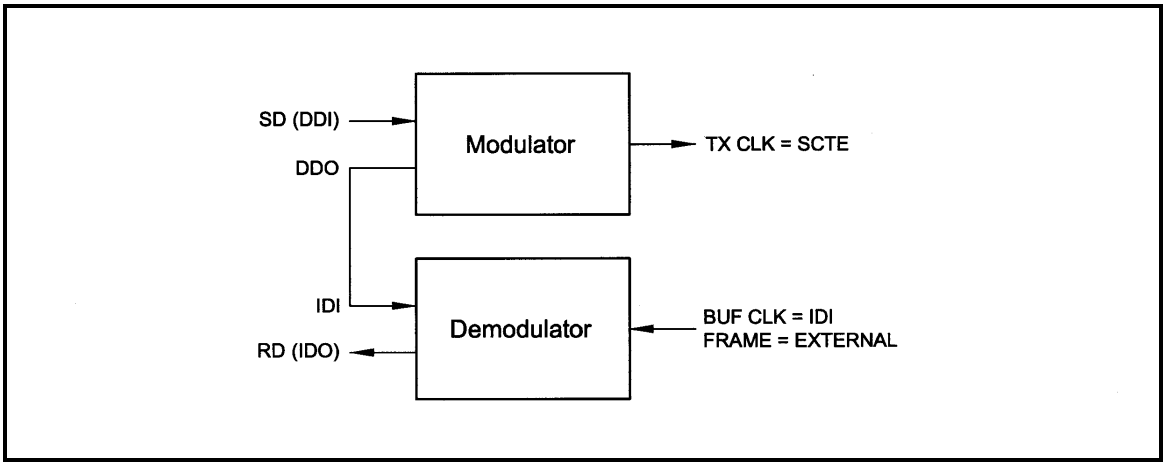


Figure H-8. Single Trunk

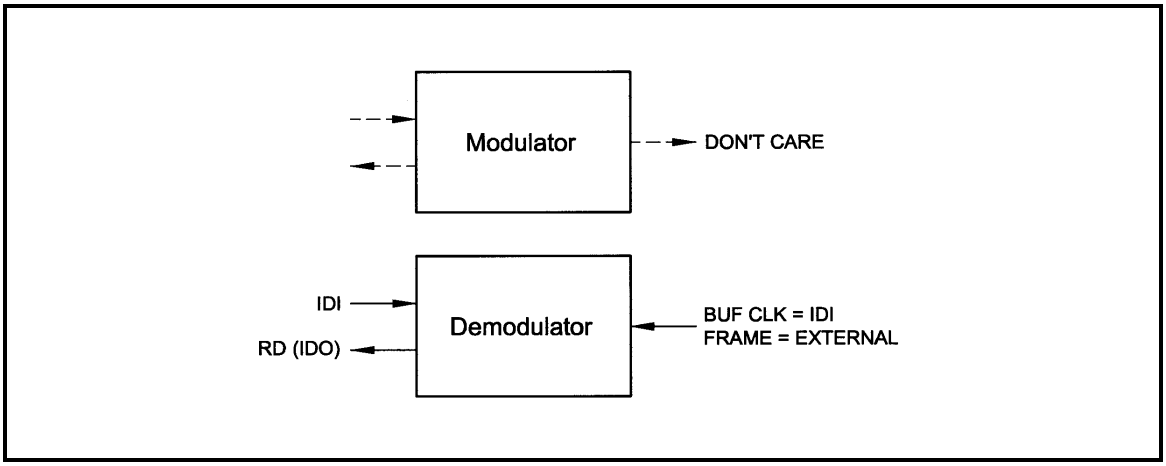


Figure H-9. Rx Only With Trunk

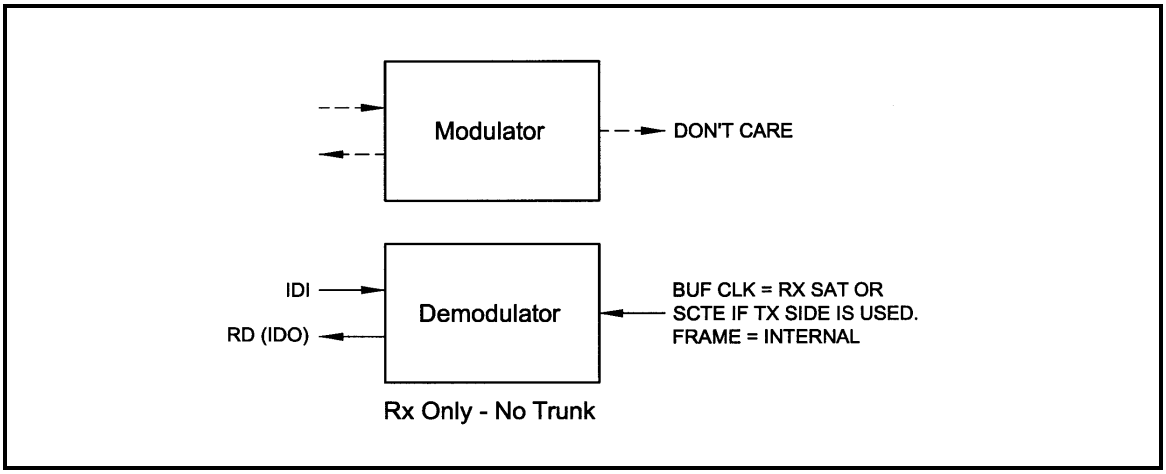


Figure H-10. Rx Only No Trunk

H.3 D&I Maps and Map Editing

The Drop and Insert multiplexer is programmed by loading it with a transmit and receive map. Maps always contain 30 entries, although, only the first "n" entries are relevant (see Table 4-5).

The modem includes provisions to copy, change, and store the D&I transmit and receive maps directly from the Front Panel or via the remote M&C link. These maps are tables that are used to define and configure the D&I functions. Each map contains up to 30 entries, which are enough to define the channel assignments for a T1 (24 channel) or E1 (30 channel) frame structure. Maps that are created are stored in non-volatile battery backed-up memory within the modem and remain unchanged after a power-down.

Table H-1. D&I Multiplexer Map Locations Used

D&I Multiplexer Map Locations Used	
Data Rate (Kbps)	**Map Locations Used (n = 1, 2,4,8,16,24,30)**
64	1
128	1-2
256	1-4
384	1-6
512	1-8
768	1-12
1024	1-16
1536	1-24
1920	1-30

It is important to understand that each map contains up to 30 usable entries. In many cases a smaller number of entries will be relevant, except when the data rate is 1920 Kbps, in which case 30 entries will used by the multiplexer. To determine the number of relevant entries, divide the data rate by 64 Kbps.

For example:

At 384 Kbps, 384/64 = 6 entries.

Therefore, in this case only the first six entries of the map would be relevant.

The Modem is equipped with eight permanently stored default maps, which are designated ROM 1 through ROM 8. The user may also define, modify, and save an additional eight maps which are designated USER 1 through USER 8.

IMPORTANT

ROM maps are read-only and may not be modified (refer to Table H-2).

Table H-2. D&I ROM Maps

ROM Map	T1/E1 Time Slot																													
#	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
3	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2
4	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
5	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3	4	5	6
6	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
7	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
8	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Since the D&I Functions are separate and distinct, two separate maps must be configured at the start of the D&I Multiplexer Operation. These are the Tx (transmit) Active Map for Drop Mapping and the Rx (receive) Active Map for Insert Mapping. The number of entries in each map is determined by the data rates selected. Each map entry consists of an IBS Time Slot assignment and the Terrestrial (T1 or E1) Channel Number to which it is assigned. Drop Mapping and Insert Mapping are completely separate and independent.

The map that is actually used for the Drop Function is the Tx Active Map; the map that is actually used for the Insert function is the Rx Active Map. Two additional maps exist: the Tx Edit Map and the Rx Edit Map. The Edit Maps are the buffer areas that are used when creating or modifying a map through the modem's LCD; when editing is complete, the appropriate map should be copied to the Active Map.

Any map may be copied to any other map with the exception of the ROM maps. These maps may only be the source of the data used to create a User, Edit, or Active Map.

Maps can be created in the map editor and stored as "User Maps". New "Active Maps" can be downloaded during Modem Operation but this will result in a temporary disruption of service on the terrestrial line or the Satellite transmission.

The following paragraphs give examples of typical configurations that could use the ROM Maps as templates. The ROM Map used would have to be first copied to the appropriate Active Transmit (Drop) and/or Active Receive (Insert) Map(s) before it could be used. To use a

modification of a ROM Map, the ROM Map must first be copied to the appropriate Edit Map, then modified, and then copied to the appropriate Active Map.

The mapping of channels to time slots is arbitrary; it is not necessary to map CH1 to TS1, CH2 to TS2, etc. The channel to the time slot mapping may be in any order within the constraints of the number of available channels.

For example, ROM Map 1 could be used as the template for an Active Transmit (Drop) Map within a modulator configured for 64 Kbps operation. Only the first time slot of the T1 or E1 frame would be dropped into the modulator transmit path. The Drop Multiplexer would know to look only at the first entry in the Active Transmit table and would ignore the other 29 entries. If the map contained an "8" in its first entry, the eighth channel of the T1/E1 frame would be sent to the modulator.

ROM Map 2 could be used as the template for an Active Receive (Insert) Map within a demodulator configured for 128 Kbps operation. The demodulated data in the receive path would be inserted into the first two time slots of the T1 or E1 frame. The Insert Multiplexer would know to look only at the first two entries in the Active Receive table and would ignore the other 28 entries. If the first two entries were modified to contain a 27 and 28, the data would be inserted into the 27^{th} and 28^{th} time slots of the E1 frame.

ROM Map 3 could be used as the template for an Active Transmit (Drop) Map with a modulator and/or demodulator configured for 256 Kbps operation. The T1 or E1 Data in the transmit path or the demodulated data in the receive path would be dropped from and/or inserted into the first four time slots of the T1 or E1 frame. The Multiplexer would know to look only at the first 4 entries in the Active map(s) and would ignore the other 26 entries.

ROM Map 4 could be used as the template for an Active Transmit (Drop) or Active Receive (Insert) Map with a modulator and/or demodulator configured for 384 Kbps operation. The T1 or E1 Data in the transmit path or the demodulated data in the receive path would be dropped from and/or inserted into the first six time slots of the T1 or E1 frame. The Insert Multiplexer would know to look only at the first six entries in the Active map(s) and would ignore the other 24 entries. To Drop the last six channels of a T1 frame into a modulator transmit path, the first six entries of the Active Transmit map should contain 19, 20, 21, 22, 23, and 24.

ROM Map 5 could be used as the template for an Active Transmit (Drop) and/or Active Receive (Insert) Map with a modulator and/or demodulator configured for 512 Kbps operation. The T1 or E1 Data in the transmit path or the demodulated data in the receive path would be dropped from and or inserted into the first eight time slots of the T1 or E1 frame. The Multiplexer would know to look only at the first eight entries in the Active map(s) and would ignore the other 22 entries.
To insert data received from a demodulator into channels 17 through 24 of an E1 frame, the first eight entries of the Active Receive map should contain 17, 18, 19, 20, 21, 22, 23, and 24.

ROM Map 6 could be used as the template for an Active Transmit (Drop) and/or Active Receive (Insert) Map with a modulator and/or demodulator configured for 768 Kbps operation. The T1 or E1 Data in the transmit path or the demodulated data in the receive path would be dropped from and or inserted into the first 12 time slots of the T1 or E1 frame. The Multiplexer would know to look only at the first 12 entries in the Active map(s) and would ignore the other 18 entries. To insert data received from a demodulator into channels 3 through 14 of an E1 frame, the first 12 entries of the Active Receive map should contain 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, and 14.

ROM Map 7 could be used as the template for an Active Transmit (Drop) and/or Active Receive (Insert) Map with a modulator and/or demodulator configured for 1920 Kbps operation. This would be used with E1 frames where time slot 16 is not used for the multiframe alignment signal and therefore channels 1 through 30 are mapped directly with time slots 1 through 30.

ROM Map 7 could also be used as the template for an Active Transmit (Drop) and/or Active Receive (Insert) Map with a modulator and/or demodulator configured for 1024 Kbps operation. This would be used with T1 or E1 frames where channels 1 through 16 are mapped into time slots 1 through 16 (in any order). Map slots 17 through 30 would be ignored.

ROM Map 7 could also be used as the template for an Active Transmit (Drop) and/or Active Receive (Insert) Map with a modulator and/or demodulator configured for 1536 Kbps operation. This would be used with T1 frames where channels 1 through 24 are mapped into time slots 1 through 24 (in any order). Map slots 25 through 30 would be ignored.

ROM Map 8 could also be used as the template for an Active Transmit (Drop) and/or Active Receive (Insert) Map with a modulator and/or demodulator configured for 1920 Kbps operation. However, this mapping would be relevant with E1 frames where time slot 16 is used for the multiframe alignment signal and therefore channels 1 through 30 are mapped to time slots 1 through 16 and 17 through 31.

Appendix I. Effcient Drop and Insert (D&I)

I.1 Introduction

The following paragraphs describe the menu structure and procedure for configuring a modem for Efficient Drop & Insert Mode.

I.2 Prerequisite

In order for a modem to be configured for Efficient Drop & Insert, the modem must have a G.703 Interface card installed and Drop & Insert option must be enabled. If the modem does not have the required hardware and/or feature set enabled, contact your Radyne sales representative to order the appropriate hardware and/or feature set upgrade. If the modem has the appropriate hardware, but the software revision is prior to AY, you will need to download the latest modem firmware from the Radyne FTP website.

The following menus illustrate how to determine whether or not the modem has the required hardware and feature set options.

```
SYSTEM
   HW/FW CONFIG
      FIRMWARE
            F05058-AY 6.1              or later required

SYSTEM
   HW/FW CONFIG
      TERR INTFC BRD
      01-AS/4975                       or later equivalent required

SYSTEM
   HW/FW CONFIG
      FEATURES
         UPGRADE LIST
```

D&I INSTALLED	required
ENH ASYNC INSTALLED	optional, required if desired
AUPC INSTALLED	optional, required if desired

I.3 Efficient Drop & Insert Mode

With Efficient Drop & Insert, the terrestrial interface selections, terrestrial framing modes, terrestrial to satellite mapping, ES to ES channel, satellite and terrestrial backward alarm functionality, and the In Station Prompt and Deferred Service alarm operation are identical to that of the Drop & Insert Open Network standard. In addition, the selection and operation of Enhanced Async and AUPC are identical to their closed network IBS counterparts. For more information on these selections, refer to the appropriate section of the User's manual.

The following menu selections are utilized for controlling the additional functionality available with efficient Drop and Insert:

MODULATOR or DEMODULATOR

NETWORK SPEC

CLOSED NET — Efficient Drop & Insert is a Closed Network selection

SAT FRAMING

EFFICIENT D&I — The satellite frame type is Efficient Drop & Insert

DATA

DATA RATE (bps)

N x 64000 — The data rate can be set to any N x 64 kbps rate based on the desired number of drop or insert slots. The following values of N are allowed based on the terrestrial interface and terrestrial framing types shown

T1	Any framing	Any N from 1 to 24
E1	Any PCM31	Any N from 1 to 31
E1	Any PCM30	Any N from 1 to 30 as TS 16 is automatically transmitted

SCRAMBLER CTRL

DISABLED — The Efficient Drop & Insert mode utilizes a frame synchronous energy dispersal technique that is always on, thus there is no need for any additional scrambling

INBAND RATE	
150 300 600 1200 2400 9600 19200	This menu is available when enhanced async is enabled. This field allows the operator to select a desired Earth Station to Earth Station in-band rate. This allows the user to optimize the In-Band Rate based on the amount of traffic that will pass over the. satellite. In most cases, this should be set to the same rate or higher than the TX & RX Async/ ES port baud rate. When this rate is set lower than the ES port baud rate, the user must insure that the actual ES to ES transmission rate does not exceed the In-Band Rate, otherwise characters will be dropped.

I.3.1 Calculating the Required Satellite Bandwidth

In order to calculate the satellite bandwidth (i.e. the symbol rate), we must first calculate the Efficient D&I Rate (i.e. the data rate plus the overhead required for Efficient Drop & Insert). From there, the calculation of the required satellite bandwidth is identical to all other modes of operation and simply takes into account modulation type and forward error correction.

In this section, we will cover the calculation of the basic Efficient D&I Rate, as well as, the two cases that alter the basic rate.

I.3.2 Calculating the Basic Efficient D&I Rate

When E1 signaling is not required (all T1 and PCM31 cases) and Enhanced Async is not enabled (the Earth Station to Earth Station link is the standard ES-ES), the Efficient D&I Rate for N timeslots is as follows:

Efficient D&I Rate = Data Rate + (N * 250 bps)

In other words, the basic Efficient Drop & Insert Rate only requires 250 bps of overhead per slot, while at the same time providing all of the functionality found in the Drop & Insert open network standard plus Automatic Uplink Power Control. By comparison, the Drop & Insert open network standard requires 4267 bps per slot, so by utilizing Efficient Drop and Insert, Radyne customers can realize a bandwidth savings of over 4000 bps per slot.

I.3.3 Calculating the Efficient D&I Rate with E1 Signaling

When E1 signaling is enabled (PCM-30, PCM30C), an additional 2000 bps per slot are required to carry the E1 signaling. So the Efficient D&I Rate for N timeslots is:

Efficient D&I Rate increase = N * 2000 bps

With the Drop & Insert open network standard requiring 4267 bps per slot, Efficient Drop and Insert provides a bandwidth savings of over 2000 bps per slot when E1 signaling is required.

I.3.4 Calculating the Efficient D&I Rate with Enhanced Asynchronous Overhead

The amount of overhead required to carry the Enhanced Async is driven by the in-band baud rate. The calculation is a two step process involving the in-band baud rate and the number of slots as follows:

X = Truncation of (In-Band Baud Rate / (N * 125))

Efficient D&I Rate increase = X * N * 125 bps

Because of the truncation, this increase in bandwidth is guaranteed to be less than the baud rate itself.

Summary and Examples:

The following examples further illustrate how to calculate the Efficient D&I rate which can be summarized for N timeslots as:

Efficient D&I Rate = Data Rate + (N * 250 bps)

With E1 signaling add

N * 2000 bps

With Enhanced Async add

(Truncation (In-Band Baud / (N * 125))) * (N * 125) bps

Example 1a:

5 Drop Slots with T1-D4 framing, standard ES to ES overhead

For 5 Drop Slots, the Data Rate would be 5 * 64000 or 320000 bps

The Efficient D&I Rate would be 320000 + (5 * 250) bps = 321250 bps

The Drop & Insert Open Network rate is over 20,000 bps higher at 341333 bps.

Example 1b:

Change to E1-PCM30 framing (E1 Signaling), standard ES to ES overhead

Add 5 * 2000 bps to our previous calculation gives 331250 bps

Still saving over 10,000 bps compared to the open network standard.

Example 1c:

Change to Enhanced Async with In-Band Baud Rate of 1200

X = Truncation of (1200 / (5 * 125)
X = Truncation of (1.92)
X = 1

Add 1 * 5 * 125 bps to our previous calculation gives 331875 bps

An increase of 625 bps to carry 1200 baud

Example 2a:

10 Drop Slots with T1-D4 framing, standard ES to ES overhead

For 10 Drop Slots, the Data Rate would be 10 * 64000 or 640000 bps

The Efficient D&I Rate would be 640000 + (10 * 250) bps = 642500 bps

The Drop & Insert Open Network rate is over 40,000 bps higher at 682667 bps.

Example 2b:

Change to E1-PCM30 framing (E1 Signaling), standard ES to ES overhead

Add 10 * 2000 bps to our previous calculation gives 662500 bps

Still saving over 20,000 bps compared to the Drop & Insert open network standard.

Example 2c:

Change to Enhanced Async with In-Band Baud Rate of 1200

X = Truncation of (1200 / (10 * 125)
X = Truncation of (0.96)
X = 0

The rate stays at the previous value of 662500

With 10 slots, there is no increase required to carry 1200 baud Enhanced Async. It is passed transparently in the Efficient Drop & Insert overhead.

Notes:

Appendix J. Ethernet Data Interface Setup

J.1 Configuring the modem to use the Ethernet Data Interface (Optional)

When the optional Ethernet Data Interface Card is installed, all of the Ethernet related menus become available and can be used to control the interface as follows:

Under the Interface Menu:
- Under the Tx Setup Menu:
  - Set the Terrestrial Interface to Ethernet.
  - Set the Ethernet Flow Control as desired (refer to Section 4.8.1 for details).
  - Set the Ethernet Daisy Chain as desired (refer to Section 4.8.2 for details).
  - Set the Ethernet QOS Type as desired (refer to Section 4.8.3 for details).
  - Set the Ethernet QOS Queue as desired (refer to Section 4.8.4 for details).
  - Set the Tx Clock to SCTE.
- Set the Tx Clock Polarity to Normal.

Under the Interface Menu:
- Under the Rx Setup Menu:
  - Set the Terrestrial Interface to Ethernet.
  - Set the Buffer Size to Zero.
  - Set the Buffer Clock to Rx Sat.
  - Set the Buffer Clock Polarity to Normal.

When Ethernet Data Interface is selected, the Tx Clock Source will default to SCTE and the Clock Polarity will default to Normal. In addition, the Buffer Clock will default to RxSat and the Buffer Clock Polarity will default to Normal.

J.1.1 Ethernet Flow Control

When disabled, if a packet is received for transmission and no packet buffer space is available, the incoming packet is discarded.

When enabled, flow control is used to throttle the transmission station in order to avoid overrunning the transmit buffers, which would in turn cause packets to be dropped. The throttling mechanism used depends upon the interface and whether it is half-duplex or full duplex.

J.1.1.1 Half-Duplex Flow Control

In half-duplex mode, the unit uses industry standard backpressure to support flow control as follows:

When available buffer space is almost gone, the modem will force a collision on the input port when it senses an incoming packet. This collision will cause the transmitting station to back off and retry the transmission.

The interface will stop forcing collisions as soon as free buffer space becomes available.

J.1.1.2 Full-Duplex Flow Control

In full-duplex mode, the interface implements IEEE 8802.3x flow control as follows:

When available buffer space is almost gone, the unit sends out a pause frame with the maximum pause time to stop the remote nodes from transmitting.

The interface sends out another pause frame with the pause time set to zero as soon as free buffer space becomes available.

J.1.2 Ethernet Daisy Chain

When disabled, Port 4 (JS4) on the Ethernet Data Interface operates normally. Data received on Port 4 that is not addressed to other equipment on the LAN side, is transmitted over the satellite.

When Port 4 is selected for Daisy Chain, any data received on Port 4 (JS4) is forwarded to of the other LAN side ports (Ports 1 - 3) and is not transmitted over the satellite. This is extremely useful in a point-to -multipoint configuration as illustrated in Figure J-1.

J.1.3 Ethernet QOS Type

When Normal QOS is selected, the interface determines a packets priority based on the following:

- IEEE 803.3ac Tag when present
- IPv4 Type of Service / Differentiated Services Field
- Ipv6 Traffic Class

When Port Based QOS is selected, the interface determines the priority of a packed based upon the port on which it arrived.

- Port 1 (JS1) has the highest priority
- Port 2 (JS2) has the second highest priority
- Port 3 (JS3) has the second lowest priority
- Port 4 (JS4) has the lowest priority

J.1.4 Ethernet QOS Queue

When Fair Weighted queueing is selected, the interface transmits packets at a rate of 8, 4, 2, and 1 from the highest priority queue to the lowest respectively. With fair weighted queueing, all queues with data in them are guaranteed to receive some bandwidth.

When Strict Priority is selected, the interface transmits packets from the highest priority queue until it is empty. It then begins transmitting data from the next highest priority queue. If higher priority data arrives, the interface finishes the current packet and then goes back to transmitting packets from the higher priority queue until it is again empty. Care must be taken when selecting Strict Priority, as it is entirely possible for the lower priority queues to be stalled indefinitely.

J.1.5 Setting Up The DMD20/DMD20 LBST Ethernet Bridge To Operate Like A FIFO

In certain circumstances, it may be desirable to have the Ethernet interface operate in a FIFO like manner with no reordering of packets. This can be established by using a single port on the Ethernet interface and setting the Ethernet QOS Type to Port Based and the Ethernet QOS Queue to Strict Priority. When Setup and used in theis manner, the packets will be transmitted in the exact order in which they are received.

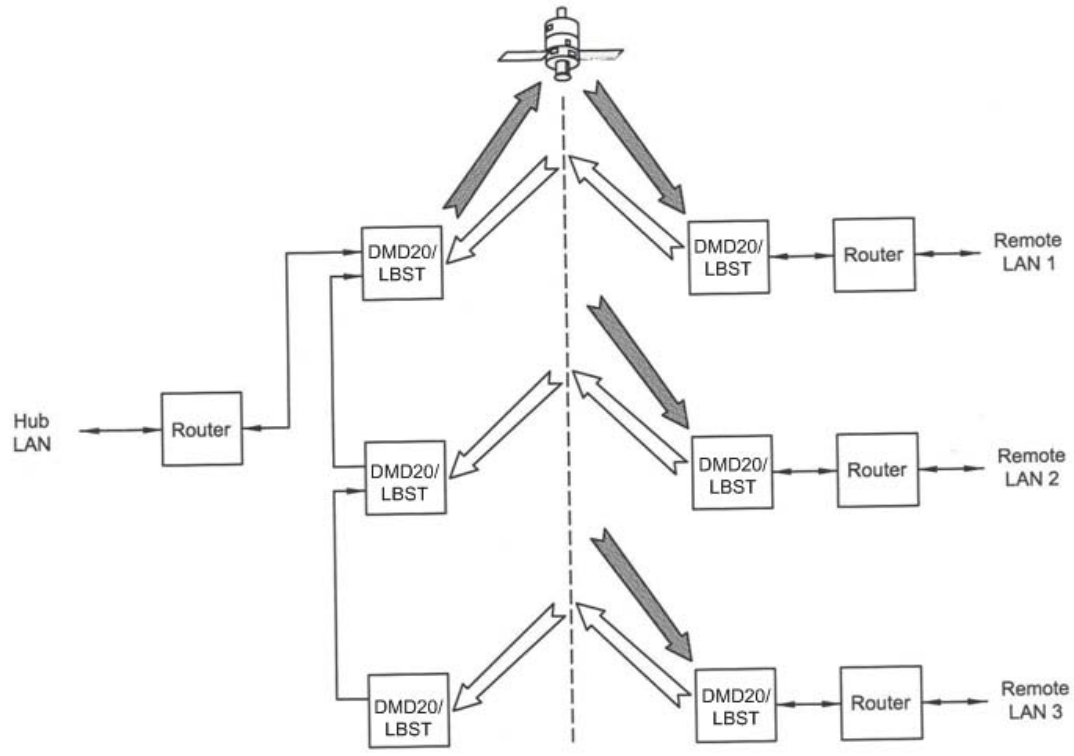


Figure J-1 Point-to-Multipoint with Daisy Chaining

J.1.6 Packet Statistics

The following statistics are available under the Monitor Menu when the Ethernet Data Interface is selected.

Total Packets: This Counter displays the total number of Ethernet packets received from the satellite.

Error Packets: This counter displays the total number of Ethernet packets received from the satellite that had errors.

Packet Error Rate: This displays the Ethernet Packet Error Rate (PER) from the satellite.

Packet Statistics Reset: Allows the user to reset the Ethernet Total Packets and Ethernet Error Count by pressing <Enter>.

Link Status: The following status is available under the Monitor Menu/Link Status Sub-Menu when the Ethernet Data Interface is selected:

Port 1 Status: Displays the current status of LAN Port 1.

Port 2 Status: Displays the current status of LAN Port 2.

Port 3 Status: Displays the current status of LAN Port 3.

WAN Status: Displays the current status of the WAN Port.

For each of the above-listed ports, the status may take on one of the following values/meanings.

Down:	The link is down.
Unresolved:	Unable to agree on connection speed.
10 Mbps Half:	Connected at 10 Base-T Half Duplex.
10 Mbps Full:	Connected at 10 Base-T Full Duplex.
100 Mbps Half:	Connected at 100 Base-T Half Duplex.
100 Mbps Full:	Connected at 100 Base-T Full Duplex.

If all four LAN Ports are down, a Tx Data Activity Minor Alarm will be generated.

If the WAN Port is down, a Tx and Rx Ethernet WAN Major Alarm will be generated.

METRIC CONVERSIONS

Units of Length

Unit	Centimeter	Inch	Foot	Yard	Mile	Meter	Kilometer	Millimeter
1 centimeter	—	0.3937	0.03281	0.01094	6.214×10^{-6}	0.01	—	—
1 inch	2.540	—	0.08333	0.2778	1.578×10^{-5}	0.254	—	25.4
1 foot	30.480	12.0	—	0.3333	1.893×10^{-4}	0.3048	—	—
1 yard	91.44	36.0	3.0	—	5.679×10^{-4}	0.9144	—	—
1 meter	100.0	39.37	3.281	1.094	6.214×10^{-4}	—	—	—
1 mile	1.609×10^{5}	6.336×10^{4}	5.280×10^{3}	1.760×10^{3}	—	1.609×10^{3}	1.609	—
1 mm	—	0.03937	—	—	—	—	—	—
1 kilometer	—	—	—	—	0.621	—	—	—

Temperature Conversions

Temperature	° Fahrenheit	° Centigrade
Water freezes	32	0
Water boils	212	100
Absolute 0	-459.69	-273.16

Formulas
° C = (F - 32) * 0.555
° F = (C * 1.8) + 32

Units of Weight

Unit	Gram	Ounce Avoirdupois	Ounce Troy	Pound Avoirdupois	Pound Troy	Kilogram
1 gram	—	0.03527	0.03215	0.002205	0.002679	0.001
1 oz. avoir.	28.35	—	0.9115	0.0625	0.07595	0.02835
1 oz. troy	31.10	1.097	—	0.06857	0.08333	0.03110
1 lb. avoir.	453.6	16.0	14.58	—	1.215	0.4536
1 lb. Troy	373.2	13.17	12.0	0.8229	—	0.3732
1 kilogram	1.0×10^{3}	35.27	32.15	2.205	2.679	—

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